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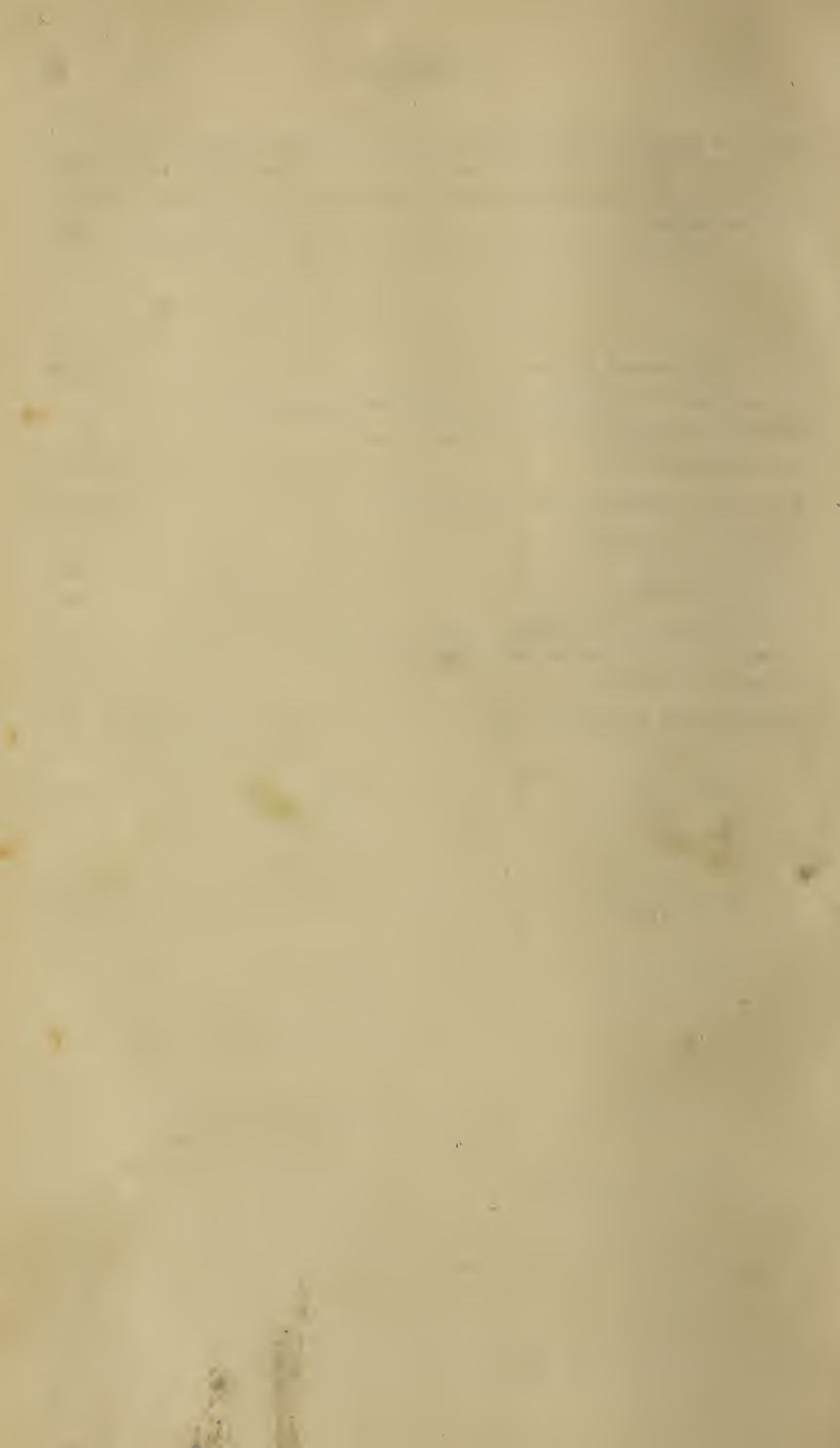
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SPECIAL LECTURE.

Wednesday, December 16, 1885.

GENERAL SIR C. P. BEAUCHAMP WALKER, K.C.B., Vice-President, in the Chair.

ENGLAND, CHINA, AND RUSSIA IN ASIA.

By ARCHIBALD R. COLQUHOUN, Gold Medallist, F.R.G.S., late Special Correspondent of the *Times*, &c.

IN the storm and stress of the Elections certain items of news which have recently reached us seem to have attracted no attention, although, of great importance to the country, they might have been expected to have exerted a powerful influence upon the minds of the people. It will be useful, therefore, now to draw public attention to certain facts which indicate clearly that there is a question requiring vigilance and resolute treatment at the hands of whatever Government may finally be placed at the helm of State.

The recent banquet given at St. Petersburg in honour of Ignatieff, as originator and signatory of the famous "supplementary" treaty of Peking in 1860; the disorders and dangers along the Russo-Chinese frontier of Kuldja, where the Cossack pickets are unable to prevent the inroads of Chinese soldier-brigands; the recent collisions along the Russo-Chinese frontier in the Amur districts; the Russian intrigues in Corea; the intelligence that Turkoman and Usbek envoys from Northern Afghanistan are imploring Russian protection; the news that Sarakhs and Mery, as well as Askabad, are now fortified positions, and that Penjdeh is already in direct telegraphic communication with Russia;—all these are indications that Russia is silently preparing to make use of her opportunity for again menacing, again striking another blow at, the integrity of India or China, an opportunity which she always finds in the hour of perplexity or extremity of her neighbour.

But where is Russia to find the opportunity? In this. She is aware that with a strong united Government established in England, a cordial understanding with China would be the keystone of our policy in Asia, and with such an understanding she would have to abandon for the time all idea of aggression. But with an irresolute and feeble Government Russia would find her opportunity, and would

seize it, and she would then be able to deal with India and China alternately, as occasion might offer. China is anxious to secure the friendship of, to act in unison with, a strong and united Government in England; but she will expect nothing, have nothing to do with a weak and disunited one. Should such a Government be placed in power, China, which has a fixed and statesmanlike policy as regards Russia, will act independently, and in doing so she would act wisely. She is now engaged, as she has been, indeed, during the past few years, in vigilant preparations, and is prepared to take prompt and bold action, if necessary.

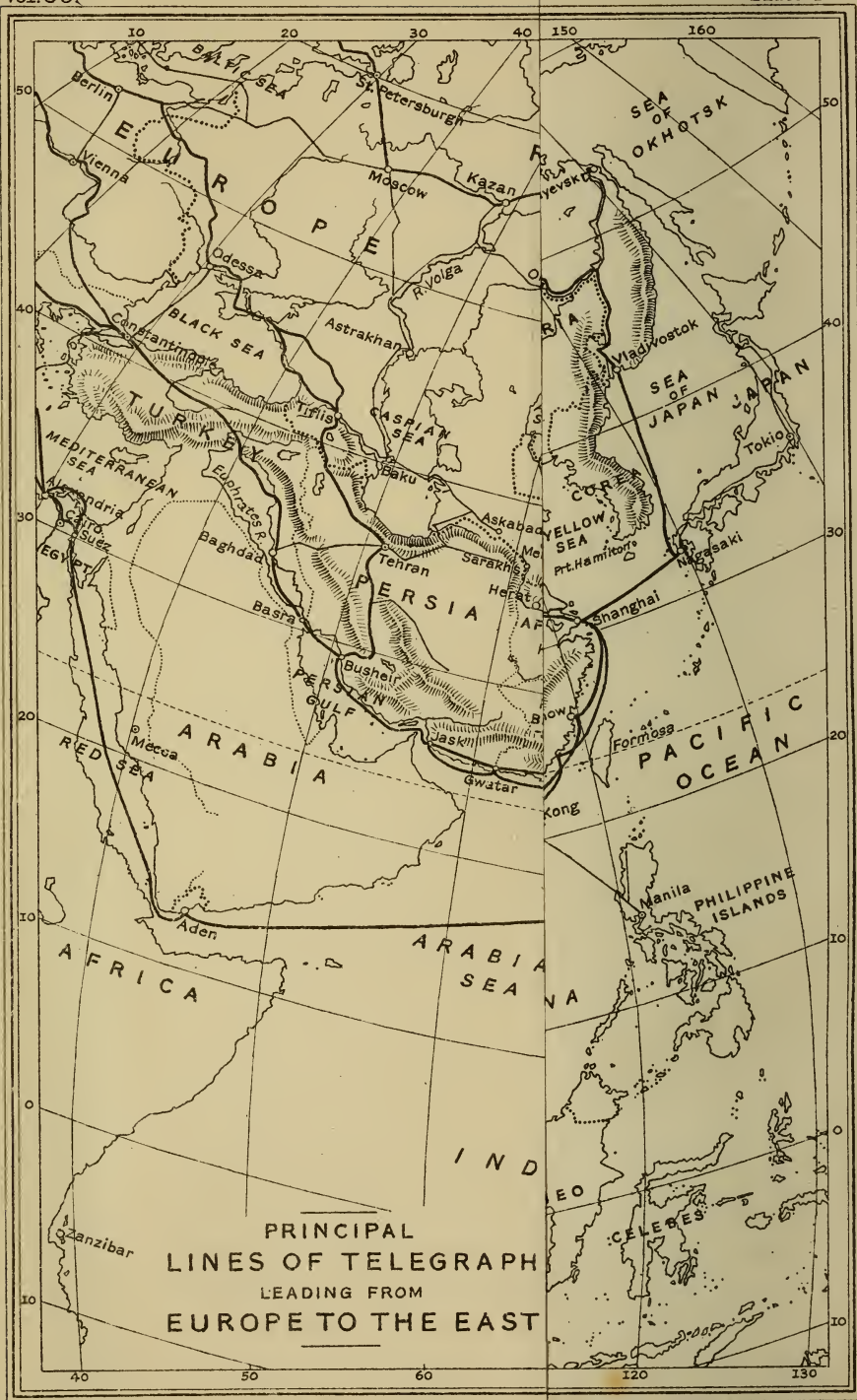
In view of the enormous interests of England, present and future, in that part of the world, and their bearing upon the interests of England, it will be well to sketch briefly the present situation in Eastern Asia.

England's Asiatic dominions and dependencies cover more than 2,500,000 square miles. She has 270,000,000 of souls under her rule, speaking some twenty languages. Her European military strength in Asia is 70,000, with 140,000 native auxiliaries, while her naval force counts some forty vessels. She has 10,000 miles of railway, and 20,000 miles of telegraph on land in Asia, and some 8,000 miles of submarine cable. She has invested in her territories, either in State loans or railways under the State, over 250,000,000*l.*, besides scores of millions sterling invested in private enterprise—agricultural, commercial, industrial—which cannot be exactly estimated. The foreign trade with these territories is over 150,000,000*l.* annually, of which over one-half is with England. The trade of other Asiatic countries with Europe is over 60,000,000*l.*, of which four-fifths is English, while an enormous coasting trade, growing yearly with great strides, is mainly in our hands. The trade between Eastern Asia and our Australian Colonies is growing yearly, and has a great future before it.

The Asiatic dominions or dependencies of Russia are two-and-a-half times as great as our own, containing over 7,000,000 square miles. But they have a population of only some 18,000,000, not one-fifteenth of our Asiatic population, scattered over this enormous region, which in economic wealth is poverty-stricken compared to our own. It is this simple fact more than any other which makes the rapid advance of Russia towards India and China in the present generation so significant. From the shores of the Caspian as her base she has, at enormous sacrifice in life and treasure, thrown forward a network of communications towards Central Asia and Afghanistan. In the Amur she is making great efforts to consolidate herself, and to perfect the communications between Vladivostock and Russian Siberia. She is now in a position to put in practice her policy of exerting pressure upon the Afghan and Chinese frontiers, and thus gain what she wants on the seaboard in the east and west. Her trade with Eastern Asia, consisting almost entirely of tea from China, is trifling.

French interests in Asia consist of her possession of Cochin China, covering an area of 22,000 square miles, with a population of 1,700,000; Camboja 40,000 square miles and a population of 1,000,000; Annam (including Tonquin) 200,000 square miles, with a





population of about 10,000,000; in all about 13,000,000. The total trade represents merely some 7,000,000*l.* sterling annually.

Our possessions furnish us with most admirable bases for commercial expansion in Asia, such as are not, and never can be, in the power of any other nation, unless forcibly wrested from us. We maintain along the avenues of our Eastern trade, as strategic points, the Suez Canal, India, Ceylon, Singapore, Hong Kong, and lastly Port Hamilton, the last of our outposts. It cannot be gainsaid that upon the political supremacy of England in the East, upon the possession and defence of India and our Eastern possessions, depends the power to expand our trade, depends the continuance of our commercial prosperity, and, as a *sequitur*, the ability to support the dense and rapidly increasing population of England. It is not necessary here to recapitulate what has been so often advanced upon the subject, as demonstrating beyond doubt the commercial value of India and the Eastern possessions in contributing to the enormous volume of home and intercolonial traffic now possessed by England and her Colonies. To willingly give up these English possessions, or part of them, there is happily now no longer any avowed desire, and there is less indifference to their advantages than there was a short time ago. To lose them would not only involve the loss of invaluable positions for commerce, and of an enormous volume of trade, but would mean also the handing them over to rivals, who are not at all averse to undertake the necessary responsibilities, and thus to reap the advantages to be gained therefrom. In one word, it would mean the loss of the commercial supremacy of England, and the rapid disintegration of the Empire.

The real outcome of the Franco-Chinese War has been, as I predicted, something never dreamt of in the plans of either belligerent. France thought to intimidate China into the surrender of her claims over an immense territory bordering the Empire proper, which would otherwise be an easy conquest for French arms. China has obliged France to make the conquest *de facto*, instead of taking it for granted, and it has been done most imperfectly, and at an enormous sacrifice in men and money, while France has during the process been much disillusioned as to the value of the prize. The country annexed in Tonquin has a rich delta, but is for the most part jungle-covered hill country, most unhealthy, perfectly uninhabitable by French settlers or traders. France will merely have the task of administering the government, with profit or loss, as fortune may determine, for the benefit of natives and strangers, more especially the traders of Southern China. France has gone near to dislocating her whole military system for a worthless object, while the Chinese authorities on their part have drained their treasuries, nominally in defence of a territory because it was under their suzerainty, but in reality to choke off Western nations from "nibbling" at China.

The war has opened a new chapter of international history which it is safe to presume was not in the contemplation of either party to the struggle. What was sure to happen some day in the ordinary course of commercial and colonial development has been

accelerated by the French proceedings in Tonquin and China, and by the movements of Russia—the shifting of the political centre of gravity, the opening of a new and larger Eastern question, and the resumption in the Pacific of the struggle for pre-eminence which was carried on a century ago in the Atlantic. It is inevitable that the question of supremacy in Asia be shortly decided in favour of one or other of the Powers, Russia or Britain. In the coming strife England must in spite of herself play a leading part, since the material interests of the British Empire are by far the heaviest stake in the game. It is even probable that the fate of the Empire itself may be eventually decided in the Eastern Seas. It is therefore a question that concerns all Englishmen in the mother-country and India and the Colonies, and, indeed, all English-speaking people throughout the world, whether English statesmen will rise to the occasion, bringing courage, faith, and intelligence to bear on the direction of affairs, whether they will instruct the people in their true interests and responsibilities, teach them the vital importance of foreign affairs and national defence, or whether, calling upon the people to centre their attention on drastic semi-socialistic “reforms,” in a lukewarm, vacillating, and cowardly spirit they will continue as of late years to embroil England and humble her before the nations, and finally cause her to drop out of the rank of Great Powers.

The force which is most constantly, if silently, in motion in this Eastern question, the factor which can always be reckoned on with certainty, is the irrepressible but not unnatural ambition of Russia, which impels her incessantly from the Arctic frosts towards the open sea, a movement which presses on Turkey, on Persia, on India, and on China, in a continuous line of front, extending 7,600 geographical miles right across Asia from the Bosphorus to the Yellow Sea. There is no need to trace here the history of the Russian advance across the barren and thinly populated wastes,—enough to bear in mind that she is now on the frontiers of India and China, the objectives of the movement. Obstacles may retard, but centuries do not change that movement, which is as steady as that of a glacier.

The ambition of France, though continuous in idea, is spasmodic and incoherent in action. Being in an exceptional sense subject to the caprice of constantly changing political parties, who, placing personal rivalries and party jealousies before patriotism, delight in discrediting and reversing each other's policy, and her action being fettered in Europe, it will count for comparatively little in the general struggle. The population of France is receding. Her finances are in a less satisfactory condition than at any other period since 1871. She has no real Colonies. Her military occupation in the East has been a failure, except in Algeria, where she has a base close by in Marseilles. Frenchmen will not go abroad as colonists or private traders. It is therefore safe to predict that France can never hope to colonize in a permanent manner. Still, France may, dangerous as it may prove to her existence as a European Power, elect to play a part in this Eastern struggle, as Gambetta and Skobelev contemplated, and as under M. Ferry she was inclined to do a short time ago. To France

herself the position she has created in Tonquin is one of grave concern. The last year and a half have changed the situation fundamentally, and though to outward appearance France and China, by the treaty executed last spring, went back to the point at which they stood on 11th May, 1884, when the Li-Fournier Convention was signed, the circumstances are wholly different now. At that time China thought she was under the heel of France, and made her submission without really testing her strength. Had France been able to conserve her prestige she might have consolidated her authority unquestioned in Tonquin, and China would have acquiesced in France's own estimate of herself as an irresistible Power. Or, when challenged to actual combat, if she had dealt a prompt and crushing blow without giving China time to organize resistance, she might still have saved her prestige, and so secured her position in Tonquin without putting her military strength further to the proof. The method actually followed was widely different from this. France has kept up a desultory and exasperating warfare, which, so far from humbling China, has only made her feel her own strength. After the terrible blunder of going to Tonquin with insufficient forces another criminal mistake was made in rooting up all the native machinery of Government, while having nothing to replace it with. Communications, so essential for the pacification of any country, were not laid down. It is now too late to replace the native officials, either killed off or turned into outlaws. The religion of the country was not strictly respected, and it cannot be doubted that the numerous massacres of Christians which have occurred have been due to the unwise policy of trying to enlist the Christian natives as auxiliaries against their brethren. The campaign has, indeed, been neither more nor less than a valuable national training and military education for the Chinese, and, although obliged to stop partly from want of money, but more on account of the threatening attitude of Russia, China is now convinced of her ability in due course to reconquer all her lost territories both on the Amur and in Tonquin. The Tonquin question was forced on the attention of the Chinese people in such a way as to rally their newly awakened patriotism to the support of the Government in its resolution to withstand aggression, and even to recover the temporarily ceded territory, and the 3,000 miles of telegraph now working in China and the extended circulation of the native press has brought into play an agency which has largely helped to rouse this patriotism. China has always shown herself tenacious of an idea. A nation that reckons its chronology by millenniums has staying power, and does not become oblivious in one generation.

It appears, then, that France has placed herself in a highly disadvantageous position in aggressively seizing a territory possessing a frontier line some 300 miles in length, conterminous with an Empire of 300,000,000 people, whom she has converted from shopkeepers and labourers to soldiers, while stirring up in them feelings of patriotism, and hatred towards the French. Tonquin may yet become a millstone around the neck of France, for she cannot abandon the new acquisition without lowering her reputation, and it will be disastrous to attempt to hold it without large forces. A Chinese army of 50,000 to

100,000 men with drill and new arms hanging like an avalanche over the passes of Kwangsi and Yunnan, and a hostile population inside Tonquin, will compel France to spend much money in fortifications and to maintain her military establishments on a large scale for many years to come. It may be conducive to the peace of Europe that France should be thus engaged, but the situation of her Indo-Chinese Empire is one to cause serious reflection to French statesmen.

The pregnant fact emerging out of this imbroglio which most concerns England and the world is the renascence of the national and military spirit in China. Hitherto the Chinese have not considered their army capable of standing before European troops, but they have now proved to themselves and the world in a hard-fought campaign that they can not only make a respectable resistance, but are able to rally their beaten forces and roll back the tide of war. They have now seen the proudest nation in Europe accept from them terms of peace on the morrow of a serious reverse, which Chinese opinion not inexcusably magnifies into a disaster. And it must be borne in mind that the Chinese armies in Tonquin and Formosa were chiefly raw levies taken from the field and placed undrilled in the front, where they learnt whatever they knew of military art. Their "regulars" were always kept in the north ready for Russia, whose diplomacy they understand well from bitter experience. Knowing that Russia never misses her opportunity, and that the only argument she recognizes is force, China kept large bodies of her best troops ready to act in the north. If under such circumstances the Chinese were not elated they would be something less or more than human. The pride which has been flushed by these successes chafed at the sudden cessation of hostilities in the very height of their victory, and the martial ardour of the nation may press for another outlet.

It has often been remarked during the past year, and has been a favourite argument with Frenchmen especially, that if France failed to chastise them, the Chinese would become so arrogant, that within two or three years, some other Power—England always understood—would be forced to take the task in hand. So far as England is concerned, at all events, I say God forbid! It were indeed a lamentable *finale* to a dreary chapter of blundering and bloodshed, were England ever to drift into a conflict with the rising power of China. So plain has the identity of interests between the two Empires become, that to all the better instructed among the Chinese the fear of English aggression is no longer a bugbear, and they are becoming more and more alive to the danger, common to both countries in the constant southward pressure of Russia, which like a threatening cloud broods over the whole northern frontier of China, Afghanistan, Persia, and Armenia. There is probably no internal power in Russia itself to arrest this movement, even were it desired to do so, and so long as she is bringing under subjection inferior races, perhaps there is no objection. Russia claims to be simply obeying a law of sunward and seaward gravitation, and following the course of her national development, which must progress until it encounters the development of other nations stronger and better than

herself. But Russia is not an over-populated country, throwing off its surplus population. She is engaged on a purely military conquest which, after enormous expenditure, has now placed her in an advantageous position for menacing, and perhaps attacking, the two richest and most populous countries in Asia. It seems therefore not unreasonable to believe that she is determined to have seaboard and ports, not for the purpose of patiently building up a commerce of her own, but whence she can threaten and cripple the commerce and power of England and China. Even among that class of politicians who make a virtue of disparaging and belittling their country, few will deny that English civilization, with all its faults, is better than Russian, and more in harmony with the modern spirit. If, therefore, it becomes a question whether Russia or England is to be predominant in Asia, it would be an excess of modesty for England to give way before the absolutely insatiable ambition of the Northern Power. Nor as regards China is there any reason why the world at large should wish to see Russian domination either on the soil of China proper, or her dependencies. The Government of Russia, equally corrupt, is no doubt more vigorous than that of China, and has availed itself more effectively of modern science in its military and industrial services. But the masses of China are in much better case than the masses of Russia, less ignorant, enjoying infinitely greater freedom, and decidedly happier. There is no Bulgaria here crying out, with either a false or a true note, for a Liberator from the North. On the contrary, there is always the passive resistance of the natives to encroachment, a resistance which, with the warlike spirit which has again been infused into this people by their struggle with France, may at any time, if assaulted, assume an active form. The acquisition by Russia in 1860 of the large territory of Manchuria, extending from the Amur River to the Korean frontier, which was filched from China by a trick of Ignatieff's, under cover of the Anglo-French guns, and when China was sorely tried moreover by rebellion, has left a sore which is not yet healed, and which is liable to break out on fitting provocation.

The events of the past two years have, among other important changes in China, caused great development in the political ideas of Chinese statesmen, who begin to comprehend their true position and interest in the world. Hitherto their conception of international relationship might be said to be summed up in the simple alternative of mastery or submission, but the acquaintance with the world which has been forced upon them during their conflict with France has brought them to see that there may be such a thing among nations as fellowship on terms of mutual respect and interest. The visit last spring of an embassy from Japan has given shape and substance to the nascent idea, for by means of full and free explanations between Count Ito and Viceroy Li Hung Chang, their mutual distrust of each other's motives was removed, and a treaty was made regarding Corea based upon a recognition by both countries of the interest which they had in certain common objects. Japanese statesmen have for some time past realized the fact, and in this as in other steps of progress Japan has been in advance of China. Of more value, however, than the treaty was the personal friendship between the two statesmen

which grew out of their intercourse, and the provision made for confidential communications whereby unforeseen occurrences in the future might be prevented from disturbing the good understanding between the two countries.

The fear of encroachment on the part of England, which until a few years ago undoubtedly possessed the minds of the Chinese, has disappeared, and the rôle of England in the world is in a measure understood, thanks to the wider grasp which Chinese statesmen now take of international affairs, and to the counsels of their most trusted foreign advisers. Not only so, but the idea of a common interest between the neighbouring Empires, India and China, has been and is being propagated by the native press, rapidly increasing in circulation and influence, thus making a great change in the hitherto exclusive and repellent policy of China, and with the introduction of telegraphic communication through the length and breadth of the country the growth of the idea has been greatly accelerated.

No argument is needed to demonstrate the value of promoting a friendly feeling between the two most populous countries in the world, so widely different in their circumstances, and yet having so many and such vital aims in common. China is learning that the policy of England, whatever it may have been, is now one of commercial expansion and development only, untainted by any ulterior designs, and as China is compelled by circumstances to take a new departure in the direction of industrial and defensive enterprise, she is disposed to look to England as her most efficient guide, and safest ally, in this new path of progress. Better far than "disinterestedness" in international relations is an interest which is mutual, clearly avowed and understood, and such is the bond which cements India and England with China. The advantages which India and England would derive from a close intercourse with China are such as now no longer displease, but entirely commend themselves to the leading statesmen of that country. The opportunity is therefore unique for developing our relations.

To India, the further opening of China and her dependencies offers the advantage of a very considerable expansion of her commerce, and possibly the better supply of labour where most needed, while to England it is a matter of national importance to increase her influence and gain the leadership in the new enterprises, financial, industrial, defensive, which China is obliged shortly to undertake. To promote these objects, increased intercourse and better acquaintance are necessary. Experience in China, as elsewhere, has taught us that one of the chief obstacles to commerce and to international relations—in fact to progress generally—is ignorance of the country and people, and the growth of trade, which has followed the treaties of 1858–60, has been as much due to the liberty of travel therein accorded, and to the better acquaintance thus brought about, as to the access given to new river and coast ports. To China a closer relationship with India (and therefore England) will mean a considerable aid towards the internal reform and consolidation of the Empire, and a pledge of tranquillity throughout the Far East.

If these views are sound, it should be the policy of the Indian and Imperial Government; and of all the neighbouring Colonial Governments, to avail themselves of every opportunity of improving their communications with the vast Empire of China, and by all natural, silent, and unobtrusive means to draw closer the bonds of intimacy, and to establish a friendship on solid and well-defined bases. One of those opportunities is the connection of India with China by telegraph, which, after full consideration of the matter, the Imperial Chinese Telegraph Company, I was assured, is willing to effect. It has been in contemplation for some time to connect the Chinese with the Russian land lines by carrying the wires from Peking to Kiachta, a distance of 1,000 miles through a desert region.

The primary object of this line would be to reduce to one-fifth the cost of the Chinese Government messages to Europe, which have been of a most voluminous character during the past two years. The secondary object would be to bring profit to the Chinese Company by opening up to the trading communities of China an extremely cheap service to Europe. But the Chinese perceive the objections to which such a connection would be exposed in that it would place their communications in the hands of a potential enemy. Their attention was therefore easily awakened to an alternative route which, though not so cheap, will afford them better security.

The Burmah-Siamese telegraph line now being constructed will have its terminus for the present at Zimmé (Kiang Mai), but is shortly to be projected to Kiang Tsen, a town on the Mékong River on the present northern frontier of Siam, about 200 miles from the Chinese frontier, and the proposed terminus of the Burmah-Siam Railway. The Chinese Company would be willing to extend their line in the south, now carried from Canton to Kwangsi and the Tonquin frontier, to the extreme south-west point of Yunnan, say to Ssumao, or whatever point might be fixed upon, provided the Indo-Chinese or Indian lines be extended over the intervening Shan territory, to meet the Chinese. This might be done from Kiang Hsen and Mandalay, giving a double line from Burmah. By one or both of these lines the Chinese would gain an alternative communication with Europe through India, and one safer than *viâ* Russia, at a moderate cost; and the commercial communities of India, China, and Siam, of the Straits and the Malay Peninsula, whose trade with China is so rapidly on the increase, would be brought into telegraphic intercommunication on practicable terms, which is by no means the case at present. That a considerable development of trade would be the result of the use of this new instrument can hardly be doubted, and to tap even a portion of the Chino-European traffic, and the whole of the Chino-Indian and Chino-Malayan traffic, would obviously be a most important gain to the revenues of the Indo-Siamese telegraphs.

The strategic importance of the connection will be obvious when it is considered that the sole dependence of Hong Kong and the Straits Settlements for their communications rests on cables which can be so easily cut by an enemy, and which at present pass through Russian Siberia and French Cochin China.

Recent events which have occurred in Burmah will make our influence paramount in that region, will strengthen our Eastern frontiers of India, help to bring order and security to the borders of friendly neighbours, China and Siam, and give us the opportunity of developing friendly relations with those Powers. On the north-western frontier of India steps are being taken which will greatly aid in giving security to our Eastern Empire.

To say that the designs of Russia make the statesmen of China and Japan uneasy is to greatly under-state the case. Russia is the nightmare of Chinese and Japanese statesmen, and the object of the inextinguishable hatred of the Manchurs. It is unnecessary to enter upon an explanation of the causes of this disquietude and dislike—they are much the same that appeal to Englishmen—enough that the Chinese and Japanese know quite well the Russian character and policy. They have not forgotten the loss of the enormous slice of Manchuria in 1860, and the repeated attempts to encroach on Japanese territory, notably in the same year 1860, when the Russians attempted to establish themselves in a fine strategic position commanding the Japan Sea, namely Tsushima (the Twin Islands). France they fear only as a somewhat restless and capricious Power, and as possibly open some day to a Franco-Russian alliance.

The interests of the three Empires of India, China, and Japan are now seen to be identical, the cardinal point of the policy of each being the maintenance of peace, which can only be upheld by a cordial understanding between the three. The internal reform and development of each country—the desideratum of India, China, and Japan alike—are only possible when peace and security are firmly assured, and when each is free from recurring menace and its dangerously disquieting influence. The chief interest of England in the East is her Indian Empire, though the commercial stake held in China is considerable, increasing, and of transcendent promise. With Japan our commercial tie is far slighter, but politically the best of understandings exists between us, and the English regard the Japanese with feelings of sincere liking and admiration, which they trust are reciprocated.

With a common policy they would form a combination that would prove an absolute guarantee for the peace of Asia. What cannot 530 millions of people with one common object accomplish, either in peace or war? To Russia they could speak with authority, whether their message was "Hitherto, but no further," or of a more peremptory character. England under the last Administration neglected the opportunity of consolidating the peace of Europe by accepting the friendship of Germany. She has a chance of redeeming in Asia the errors committed in Europe, but she has also a chance of repeating them with still more disastrous consequence. In China and Japan there are statesmen worthy of the name, while in India we are fortunate in having at the present critical time our ablest diplomatist, and one of the most far-seeing statesmen not only of this country but of Europe.

The folly, or rather the madness, of the view held by a certain

section of politicians that we can altogether avoid and ignore foreign affairs—which affect so closely every social question in our country, and concern every man, woman, and child in the kingdom—is made clear with a question of this sort, not looming ahead in the dim and distant future, but staring us in the face. It is my deliberate opinion that, should the country be ruled by a disunited Cabinet, with opinions as divergent as the points in the compass, we must abandon all hope of any early development of our relations and expansion of our commerce in this direction, and that China will leave us to face Russia alone. It is not unreasonable to predict that in that case we should again have procrastination, vacillation, surrenders, and enormous expenditure at the eleventh hour to avoid collision, and not improbably be drifted into an unnecessary and terrible war with Russia.

The CHAIRMAN : I need hardly remark, after the very able lecture to which we have now listened, that we shall do wisely in following the custom of this Institution in inviting discussion. If Captain Colomb is here, who has so often assisted us with his able pen in questions very similar to that which Mr. Colquhoun has discussed to-day, I will ask him to open the discussion.

Captain J. C. R. COLOMB : I obey orders for the purpose of giving others an opportunity to collect their thoughts as to what they propose to say. Unfortunately I did not receive a copy of the lecture in time to read it before the meeting, and therefore I can merely say this, that I think nobody who has at all looked into the history of the circumstances of the East can fail to see very strongly that the lecture we have just heard is one which should sink deeply into the hearts of every one who believes that we are an Empire and not a country, and who wishes us to remain so. Of course the whole history of the advance of Russia has been a complex one, and the more westerly portion of her advance has necessarily attracted chief attention. But her persistent effort through centuries, to get to the sea on the Pacific, and to get southward on that ocean, has not commanded sufficient attention from the statesmen of England as far as we can recognize the practical results of their policy. I will give one instance. Considering the ordinary possibilities of a combination brought about by the very facts and circumstances of our position in the East between France and Russia, I must say I think the way we treated China during her recent struggle with France is very much to be deplored. I myself believe that our real survival in the new civilization on the other side of the world alluded to by the lecturer very much depends upon our recognition of this fact, that the interests of China and England, as regards Russia, are identical. Of course, the civilization of China is very much behind our own, but if we are worthy of leading the future of the world we must face that fact. I most sincerely hope that we shall not shrink from our responsibilities. The first necessity of our not doing that is to understand them, and one of the great advantages and benefits that the lecturer has conferred upon us in England has been the placing of those facts clearly and accurately before the people of this country.

Sir ROGER LETHBRIDGE, M.P. : Ladies and gentlemen, I venture to add a few words to the tribute of praise and admiration, for the paper we have heard, that has just been offered by Captain Colomb, and I wish to speak in this distinguished assemblage of Service men, from another point of view than that of Captain Colomb—rather from the point of view of the civilian, and the commercial classes of England. I venture to do so because I have the honour to represent an important London borough that depends very largely for its prosperity on the commerce and the trade of the Empire. Now I think that Mr. Colquhoun has done a very important service to the country, and to his fellow-countrymen, and has shown himself a thorough patriot, by the courage and persistence with which he has brought before the people of England the very important political changes that are imminent in the Far East. I think he has done well this afternoon, especially in bringing those political phenomena before the notice of the representa-

tive men of the British Services. I had the honour of being present, and of taking part in the discussion, when Mr. Colquhoun laid a somewhat similar series of facts before the London Chamber of Commerce, the representatives of the trade and commerce of England, and I can bear full testimony to the deep impression that was produced by the facts which he laid before us, every one feeling that he had presented a picture which deserved the fullest and most careful consideration of all English statesmen interested in the trade of England. He has shown us that we are brought face to face at the present moment in Asia with one of the most important commercial revolutions that has ever happened in the history of the world. He has shown us that the results of the last few years, especially of the quarrel with France, and doubtless the tendency of Chinese civilization generally, have been to cause a reawakening of the national spirit and of the civilization of China. He has shown us that we are now facing a renaissance there, not only of commercial spirit, but also of military spirit. He has shown us that we are to have not only a development of telegraphic and other communications in China, but that China is ready to open up her railway system to the commerce and trade of the whole world. It is only for us to consider for a moment what Mr. Colquhoun has pointed out, that China means a population of some 300 millions, something like one-sixth of the whole human race; a population not only so vastly numerous as this, but also ingenious, industrious, thrifty, and frugal to an extent perhaps equalled by no other population on the face of the earth. What then must be the result to the trade and commerce of the world of such a reawakening, such an opening up of the country as that to which Mr. Colquhoun has directed our attention? It seems to me perfectly clear that whatever nation rises to the occasion, whatever nation takes upon itself, first of all, to make the railways of China and then to utilize those railways, to attach itself by political and commercial ties to the Chinese Empire and people, must inevitably become, from the extent of the population and from the genius of the Chinese people, the first commercial people in the world. And why, ladies and gentlemen, should that be the Russian or the French people, when the English people have always shown themselves the pioneers in every such enterprise? I trust that the statesmen of this country will not be behindhand in seeing the immense importance of the crisis to which Mr. Colquhoun has directed our attention. It is perfectly clear that if we do not seize this grand opportunity we shall be abdicating that proud position which England has always held in every part of the world, and I do trust that the interests of the Indian Empire, which are identical herein with those of England, will be fully considered. It is perfectly clear that both England and India will derive incalculable benefits from the opening up of China, provided only that we seize the opportunity, and that we ally ourselves closely with those Chinese statesmen of whose intelligence and genius Mr. Colquhoun has spoken, not only in resisting the advance of Russia or France in those regions, but in building up for ourselves a friendly community of interests with that immense Empire of China.

Major GRIMSTONE: I should like to ask the lecturer one question, whether he considers that Burmah, lying between Hindustan and China, ought to be annexed or protected by England?

Colonel MALLESON, C.S.I.: There is only one drawback to the entire satisfaction with which I, and I am quite sure every one in this room, have listened to the very able lecture which Mr. Colquhoun has given us, and that drawback arises from the fact that having often attended these lectures, having heard from this table truths uttered regarding the protection of our Empire in the East, which were undeniable and which were admitted, the statesmen of this country have on every occasion neglected to profit by the advice which has been offered, and have allowed matters to run on as if no such advice had been given. I sincerely hope that that may not be the case on the present occasion, and that we may not have to feel that this theatre is the theatre of Cassandra, where educated and instructed gentlemen utter truths affecting the protection of the Empire which are persistently neglected by the statesmen of this country. I recollect on a former occasion that when a lecture, unequalled for its ability, was delivered by a gallant Officer in this room, another gallant Officer whom I see before me rose and asked, "Is there any one here who thinks that the statesmen of this country will be moved by these warnings?"

Those statesmen did not listen to those warnings. I sincerely hope that we may not have to say so on the present occasion. I only wish that on the occasion of the delivery of lectures such as that which Mr. Colquhoun has delivered this afternoon, we could see members of the Cabinet sitting in the chairs around the lecturer and listening at first hand to the advice and instruction, which, if they heard, I am quite sure they would take the fullest advantage of. It is one satisfaction that on the present occasion no one has risen to impugn the soundness of the advice which the lecturer has given, and which has been so ably supported by the two gentlemen who rose to follow him in the course of the discussion.

MR. DELMAR MORGAN: It has been a great pleasure to me to listen to the lecturer, though I must differ from Mr. Colquhoun in many things that he has said. During my travels in Central Asia I did not find that the Russian advance was a serious menace to this country. Seeing how very weak they, the Russians, are, what long lines of communication they have, and how very small their numbers for aggression, it is very unlikely that they would ever invade India. I have heard Russian Officers speak about it, but more from braggadocio than from any serious idea of ever invading that country. The lecturer also alluded to the Amur country. The extreme smallness of the population of Russia in Asia may be judged of from statistics that I saw recently in a work published on the Amur country, and which stated that the total population of that very large extent of country is only some 37,000.¹ Some years ago I read a paper in this Institution on the Russian advance along the Turcoman country, and I then said that I thought they would have a very difficult task before them. Events have marched, however, somewhat more rapidly than was then anticipated. At the same time, since that has occurred, they have, as I understand, been losing very heavily from sickness; we have heard that 80 per cent. of their men have been in hospital at Askabad and Sarakhs, or in the neighbourhood of those towns, and I am sure that they find it a much more difficult task to hold that territory than they imagined.

Captain FRANCIS BEAUFORT, R.A.: It may be slightly presumptuous in me to rise to address this meeting upon this subject, but I cannot allow a statement made by the last speaker to pass quite unnoticed as to the inability of the Russians to attack us. About a fortnight ago an article appeared in the *Moscow Gazette* on Russian affairs in Asia, giving, curiously enough, first of all a history of the Mounted Turcoman Militia, and then describing the great importance of this Militia as an attacking force in the direction of India. After having described the forces, it went on to say that there was a proposal absolutely drawn out for increasing these forces to 15 regiments of 6 sotnias with 160 men each of mounted cavalry, and 10 regiments of 5 sotnias each of infantry mounted on camels. The article ends by stating that they consider it would be absolutely impossible to prevent such a force as this, not only getting to Herat, but also to Quettah. I think, therefore, that the question of the inability of Russia to attack us in India is one that is past and gone.

Major BELL: I rise to say, if I may be permitted to do so, that possibly the lecturer's object to-day has been not so much to call the attention of statesmen or of soldiers to this matter as to bring it to the notice of civilians, and in the wisdom of that course I quite agree. The question is one of the advance of the civilization of those realms by the introduction of commercial venture. As we are aware, in many instances, such as, say, "The Labourers' and Artizans' Dwellings Company," direct profit is not so much immediately an object as doing good; so I think the lecturer is desirous of showing that the great lesson of this moment is, that if commercial men put themselves forward and take the initiative in the form of opening up railways and telegraphic lines, they will do more to civilize that country and produce goodwill amongst men than could be done by any other possible means at the present time.

Mr. CHARLES MARVIN: I rise to express my strong dissent from the remarks

¹ This number includes both sexes, and refers to the year 1869. It is at the rate of one inhabitant to four square miles, or rather less, taking the area of the province of the Amur at 164,000 square miles. This does not include the maritime province of Eastern Siberia, where the population, native and Russian, is still less.

which have just been made by Mr. Delmar Morgan with reference to Russian ideas with regard to the invasion of India. I do not think we need go to purely Russian sources to controvert the notion that Russia has no idea whatever of attacking India, because there is a whole literature existing on that subject. I might refer Mr. Delmar Morgan to a book published by Mr. Sutherland Edwards, a well-known Russian scholar, entitled "Russian Projects for the Invasion of India," and further to the testimony of Colonel Burnaby, who travelled in that part of Central Asia which was traversed some time ago by Mr. Delmar Morgan himself. I think it is a matter for very great regret that Mr. Delmar Morgan's experiences were confined solely to Kuldja and that part of Central Asia. I imagine that if he had penetrated to the Caspian region he would not have expressed the opinion which he enunciated a few minutes ago. On the map which is before the audience this afternoon, one can see very clearly the remarkable position that Russia occupies on the Caspian Sea, and the excellence of her communications, both behind and in front, for attacking India. For example, there is the route of the River Volga, which is open to steamboat traffic, and is covered with thousands of barges, all floating down in the direction of the Caspian Sea. No one will say that that is a very bad route of communication. On reaching the Caspian, there is the Caspian Marine, and afterwards there is the railway (which is shown upon the map) which has been completed as far as Askabad within the last few days. From Askabad to Herat there is simply a distance of 388 miles to be traversed by railway, and that distance will be further reduced to 240 miles next spring when Russia completes her railway communications to Merv. Thus we see that from the Russian position next spring at Merv the distance to Herat will be simply a matter of 240 miles across a very easy country, and from Herat there are only 400 or 500 miles of equally easy country to traverse in order to reach the English outposts. I imagine that when a Russian force reached the English outposts it would reach to all intents and purposes the British Empire in India: so that the long and difficult lines of communication to which Mr. Delmar Morgan referred may undoubtedly exist between Russia, through Siberia, to Kuldja and Kashgar, but certainly they do not exist through Russia to the Caspian, and the Turcoman and Afghan regions, to India. There was one point in the lecture itself to which I should like to call your attention. Mr. Colquhoun spoke of Russia not being a colonizing Power.¹ That is an opinion which is very often expressed, but I do not think it will bear thorough investigation. True, Russia does not ship away from her shores thousands of emigrants annually, but at the same time the Russian population is always spreading from the central provinces round about Moscow in the direction of the Caspian and Central Asia; for instance, about 8,000 or 10,000 Russian peasants yearly quit the railway terminus at Orenberg to settle in Central Asia. From the southern provinces I believe the stream of emigration to the Caucasus is about 10,000 or 15,000 peasant families every year. As a matter of fact, Russia has so far colonized the Caucasus that of the population of 6,000,000 composing the inhabitants of the administrative district of the Caucasus fully one-third are Russians or Cossacks. One other point is this. I do not think any one here will undervalue the moral value of the Chinese alliance; at any rate, no one has as yet attempted to controvert the opinion expressed by the lecturer. It may be assumed, therefore, that the opinion of the lecturer is shared by most persons present; but while myself fully concurring in what he has said, I think that the Chinese alliance ought not to be the sole method for defence of India. I have a very strong opinion myself that in this world we ought not to rely too much upon other people for assistance in times of danger. In my estimation, a man has only one safe ally to look to in this world—that is, himself; sometimes, of course, including his wife. To defend India, two measures are needed. In the first instance we require a strong position in Afghanistan for the Indian Army. We know very well that if Russia, on the completion of her

¹ Mr. Colquhoun's words were—"Russia is not an over-populated country throwing off its surplus population." In his reply, he explained that I was mistaken in supposing them to mean that she was not a colonizing Power. I therefore quote the particular passage I referred to.—M.

railways to Merv next spring, attempts to attack India, the whole of the Indian forces on the Indian frontier will have to be concentrated to meet Russia somewhere, either at Candahar or between Candahar and Herat. At the present moment the Government is very busily engaged in forming an entrenched camp at Pishin; but the majority of politicians and Generals I have met say that if Russia moves down upon Herat we shall immediately occupy Candahar. Now it seems to me that if Russia is able to concentrate an overwhelming force in the Caspian region¹ we ought not to content ourselves with simply a temporary camp: we ought to get into our permanent position as soon as possible, and that permanent position, I believe, in the opinion of some of our ablest Indian Generals, is some position on or near Candahar, stretching to the Helmund. But that is not all. The Indian Army would be engaged in defending whatever position was taken up near Candahar, and something, therefore, would be left for the Army in England to do. It is commonly thought that in the event of a war with Russia the English Army would co-operate with the Turks in an attack upon the Caucasus. Now I hold very strongly to the opinion that the day is completely past for doing any good whatever in the Caucasus region. Russia has almost entirely annihilated the tribes there; a rising would be almost impossible; and even if we penetrated to Tiflis we should not sever the Russian communications stretching between Moscow, *viâ* the Volga, and the position she would take up in or near Herat. Consequently, a campaign in the Caucasus would be a mistake, and would have no effect whatever upon the general operations in Central Asia. Therefore I think, in the event of a war with Russia, the English Army would have to co-operate with the Indian Army from the base of the Persian Gulf. In that case railways stretching from the Persian Gulf would be essential, and I think they should be taken in hand by the English Government as soon as possible. If I may say another word, it is simply this. Within the last few days a statement has gone forth, on the authority of an eminent personage,² that neither England nor Russia could occupy Herat in their present condition of railway communication except at a vast outlay. That may be possibly the opinion of the English Government as regards India, but certainly as regards Russia I am persuaded the majority of Russian Generals will altogether scout the notion. Russian Generals, with scarcely any exception, believe that Herat could be occupied with very little difficulty, and even if there be any difference upon that point they certainly all believe that it could be held by a Russian garrison with remarkable ease, particularly as the railway, which is now finished to Askabad, could be extended easily to Herat within a twelvemonth.

MR. E. CAZALET: It is an old saying that nothing is perfect in this world, and that is applicable even to our own institutions, and to our own free press. What I mean is that the most ingenious and practical ideas suggested to Russia how to increase her power and how to injure British interests in Central Asia or elsewhere have been put into the minds of Russian officials by what they have heard and read in this country. It strikes me that we are somewhat in the position of a claimant who considers it his benefit to instruct his enemy's solicitor against himself. The danger does not lie principally, although it may to some extent, in Russia or in Central Asia; the danger is at home, and it proceeds from the absence of a *uniform foreign policy*. Look at Bismarck and the manner in which things are managed in Germany, how the interests of Germany have been maintained, and how the dignity of that country has been raised of late years. If there were sufficient patriotism and self-abnegation to have a permanent Chancellor for Foreign Affairs, irrespective of Party, be he Lord Salisbury or be he Lord Dufferin, the power of England in foreign matters would be such that we should have no trouble either with Russia or anybody else. Parties carried away by political feelings might squabble over home affairs, but foreign matters would be in the hands of a man who would be supported and respected by the whole country.

¹ "And on the Afghan frontier," *vide* "Russia's Power of Attacking India," a pamphlet which puts the case in an ampler form. London: W. H. Allen & Co., 1885.—M.

² Sir Henry Rawlinson.

The CHAIRMAN: I think we are all very much indebted to Mr. Colquhoun for his lecture. I cannot say with what interest I have listened to it. For eleven-and-a-half of the most important years of my life I was rubbing shoulders with Russia, and I acquired large experience of her during that time, some of which, perhaps, I had better keep to myself. I was also in China when Colonel Ignatieff, as he then was, signed the treaty which filched a portion of Manchuria, as was properly said by the lecturer, under the cover of English and French guns. Before I say anything more I would recommend anybody who wants to know the real history of the Russian attempt to steal the Island of Tsushima, to read an article by my old friend Lawrence Oliphant, in the last number of "Blackwood." I happened to read it three or four days ago, and the moment I got Mr. Colquhoun's paper I determined to mention it here, in case others had not had the pleasure of reading it. There was one conclusion at which I arrived during my residence in Berlin from very large intercourse with Russians, and with those who knew Russians better than I did, and that is, that one feature which lies at the bottom of all Russian aggression on England is purely and entirely commercial; it is the desire to close every country on which Russia can lay her hand to English manufactures. Very soon after I came home from Germany and established myself in London I dined at a large City dinner, where I had next to me a gentleman whose name was perfectly familiar to me as a very influential and wealthy merchant in London. It was at the time when certain measures were taken by the then Government to express a certain opinion on the Russian advance towards Constantinople, and we got into conversation on the question of the Russian movements. He said with rather a piteous tone, "Why won't you let poor Russia alone? Why should you not let Russia do what she pleases?" I turned on him rather sharply, and said, "I happen to know who you are. I happen to know that you are a mercantile man of very considerable importance and influence, and I now tell you what you do not seem to know: the whole point of Russian aggression on England is to destroy your commerce, to prevent you from sending English goods into countries over which Russia can gain the control." And I believe I have come to a perfectly right and fair conclusion. I was very much struck with another point which came under my notice several times, viz., the extreme probability of Russia forming an alliance with France. And I found this also, that notwithstanding their extremely courteous and kindly manner to us as individuals, whenever we come in contact with Russians, the Russian hatred of England is not to be extinguished—that it is inextinguishable. And why? They were perfectly ready to shake hands with the French, because the French went into the Crimean War for the idea of their Emperor, but they hated us because we went into the Crimean War on principle. If the French were prepared to throw up the sponge and get out of the Crimea as quickly as they could, we were ready to have gone on if they had only remained to back us. The true opinion respecting Russian advance towards India, in my opinion, and you may take it for whatever it is worth, has been expressed over and over again by a great Indian authority, who is firmly of opinion, I believe, that the Russians have no further intention of aggression upon India than that they should so occupy us there that we cannot interfere with their designs in Europe and Asia Minor. That we should form an alliance with China is, I think, a notion with which none of those who have been in China and have served in China, as I have, will disagree, and there is one small fact which will greatly facilitate that result. We occupied Peking, certainly, for six weeks—I am not sure whether it was for longer—we burned the Emperor's palace, and we certainly knocked their forces to pieces in a way which could not be pleasant to anybody; but I perfectly remember the remark which was made when we were about to evacuate Peking, which came from the common people: "You have been here for six weeks, and not a single poor man has been robbed of a cash," a "cash" being the smallest possible coin that the human intellect can conceive. I believe we left behind us after that campaign a very friendly feeling amongst the people to whom we had gone. I think, perhaps, Mr. Colquhoun will be desirous of saying a few words in reply, after which I shall have the pleasure of proposing a vote of thanks.

MR. COLQUHOUN: Sir Beauchamp Walker, ladies and gentlemen, I do not wish to weary you with many remarks, but I should like to say a few words in reply

to what has fallen from the various speakers, and especially from Captain Colomb. I have not the pleasure of the acquaintance of that gentleman ; but of his writings, I may say that ever since I have taken an interest in the affairs of the nation, and especially of the militant services, I have read everything that has come from his pen, and I think no man has done greater service to the country, in the matter of national defence, than Captain Colomb. His opinions on all questions, on which I have any right or title to pronounce any judgment or hold an opinion, I have always considered to be exceedingly sound and far-seeing. Captain Colomb is well known to most of you here as a writer who has made the question of our Colonial Empire entirely his own. In this particular question then, as regards the value of the friendship of China, I think his opinion is of great value, and when I was going to lecture here this afternoon, I took the liberty of asking him to be present, feeling sure that anything that he had to say would be very valuable and much appreciated. Captain Colomb told us that it may be taken for granted that the policy of Russia is to place herself in an advantageous position on the frontiers of the two most populous countries in the world, and the two richest Empires of Asia, for the purpose, not perhaps of directly attacking those Empires, but of being able at any convenient time to exercise pressure—that is, to menace and coerce them—and by that means gain what she wants elsewhere. If this be realized as the whole basis of Russian policy, and kept clearly in mind, it will be readily understood that, while Russia is relentlessly pressing forward in her endeavour to place herself in such advantageous positions both as regards India and China, the positions she desires elsewhere are to be found, not on the Indian littoral, or on the coast of China itself, but in the extreme West and extreme East—in the neighbourhood of Asia Minor and the Levant, in the Persian Gulf, and in the Sea of Japan and the China Sea. Captain Colomb very properly drew attention to a point which it seems to me has never been publicly brought forward by any writer, and which, so far as my experience goes amongst the commercial community—and I have a very considerable experience of that section of the public—has never presented itself to their minds. That is, that although Russia is pressing forward on the Afghan frontier, and the attention of our military men and politicians, who take an interest in national defence, is concentrated entirely on that point, we may make up our minds that when Russia chooses to take the next opportunity again to exert pressure—that pressure which begets feelings of danger and disquietude throughout our Indian Empire—she will not then seek to attack India itself, but we shall see her attacking our interests either in the China or Japan Seas, or else in the extreme west. I ask your attention for a few seconds to the consideration of the meaning of a forward Russian movement being made in the China and Japan Seas. I have no doubt if we could ascertain the opinion of the majority of our countrymen to-day they would say : “ Well, let Russia do what she likes there ; it does not matter.” But when we consider that in that region we have not only a rapidly increasing commerce with China, the sole country now open to our energies in which we can hope for any large commercial expansion, and when we further consider that that growth of trade is an absolute necessity for this country with its rapidly increasing population, with foreign competition growing keener every day, and with hostile markets closed against us, the value and importance of strategical positions in the China Sea will become more and more evident to us. It is in China alone, in my opinion, that we can look in the future for any great expansion of our commerce, and for any considerable strengthening of our position in Asia. It is therefore impossible that we can ever permit Russia to come down and occupy a strategical position which would simply mean a lasso cast round the throats of China and Japan, and a menace to our enormous and rapidly growing interests in those regions.—With regard to the remarks made by Mr. Delmar Morgan, I think what I have already said will answer what he had to say. I think he must be the only man in this theatre at present who is of the opinions put forward by himself. As for making a special plea on behalf of Russia, on the score that she is anxious to avoid war, I think every one who is at all acquainted with Russian policy knows that she is exceedingly anxious to avoid war so long as she can get her own way without going to war, and she takes precious good care to try and get, and generally succeeds in getting, that way. Therefore, all we have to

do is to watch closely the movements of Russia, and always to bear in mind that the time when Russia will move is not when we are free from difficulty and danger, but when we are *in extremis*, when we are in the throes of some great political or other conflict. As for the *enormous* sacrifices in men and money that have to be made by the Russian commanders in crossing those *vast* steppes and desert territories in order to get to the objectives of their movements on India and China, to which Mr. Delmar Morgan directed our attention, I think his argument surely tells against himself. Why should a country like Russia, not over-populated, not seeking any natural commercial expansion, make these enormous sacrifices, unless it has some design when the end of this most costly movement be attained? The very sacrifices that they have made and are continually making in crossing these regions show conclusively that there is something which they consider to be of inestimable value to be gained at the end.—Mr. Marvin, in the remarks he made, fell into an error in saying that I had indicated that in my opinion Russia was not a colonizing Power. My remarks were directed to France and not to Russia. Whatever Mr. Marvin says I am sure is listened to with interest by every Englishman, because he has done a great deal to popularize in this country the truth regarding this question. He is, however, mistaken in assuming that my opinion, in regard to this Russian question, is that we should depend *solely* upon a Chinese alliance. I should be the last man to advocate any such thing. My object in placing this paper before the members of this Institution was, as a civilian, merely to put before them the political, social, and other aspects of the situation, to present to them certain facts on which military experts should build up a policy of defence. It will be noticed that I have not presumed to sketch out any particular military line of action for protecting our interests. That I have left entirely to military experts. So far from relying solely upon China, I am personally of opinion that we have to defend our interests in the East, and in India especially, in a very different way. But I do not believe that the future conflict with Russia will be fought in the neighbourhood of Afghanistan. When we come to face Russia, it will have to be done in the West and extreme East. I hope that having cemented a solid friendship with China, having developed our intercommunication and given a good earnest that we are prepared to give as well as take in the matter of international relationship, we shall move with them in resenting any forward movement or attack of Russia. I believe that the conflict, should it come, will be fought out in the region of the Amur with Chinese forces directed, I trust, by English Officers, and in the Black Sea, and I hope also in the Baltic.—Mr. Cazalet drew attention to the possibility that gentlemen like myself, who point out the position of affairs in Asia as regards Russia and England, do an injury to their own country in this regard, that they lay bare to Russia the weak places in our armour. It is a remark that you often hear made, but I have invariably found it made by men—I am sorry to have to say so—who do not take any great interest in their own country. I am sure that Mr. Cazalet is not one of these, from what fell from him afterwards, but as a rule it is as I say. No more foolish argument can be used, because any one who knows Russia or the Russians is aware from bitter experience that they are aware of our weak places very much better than we are ourselves. I have only recently returned from a long sojourn in China, where I had occasion to meet Officers of the different squadrons in that part of the world, amongst others the French and the Russians, and I found when matters were in a very critical position last spring, when Consols were 95½, and when it seemed very possible, to say the least, that war might break out between England and Russia, that while we knew exceedingly little regarding Russian Siberia and the Amur Provinces, while we knew nothing regarding the condition of Vladivostock, the Russians had a complete Gazetteer of every single one of our colonial possessions and strategic posts, and of the precise condition of our armaments and garrisons. So complete was this Intelligence-Guide, that, as I wrote to the *Times* on that occasion, it would have been a perfect godsend if it could have been placed in the hands of our own Officers. Such was the position of affairs then. I think, therefore, that every one here will agree with me that we lose nothing by laying bare to the Russians our weak places, because they are already aware of them; but we may do a very great deal of good by trying to instruct and interest the middle and artisan classes of

this country in what is so really and truly a question of national importance. —A gentleman asked a question regarding Burmah, whether I considered the annexation or protection of Burmah by England the better course. I believe the rules of this Institution forbid our trenching upon politics, and it would be almost impossible to answer that question without doing so.—In conclusion, with reference to the exceedingly apposite remarks that fell from our Chairman, who has had a long experience of Continental countries and of Russia, I think that every one in this country, who takes any interest in this question, the more he looks into it, must become the more convinced that the *raison d'être* of Russian policy in making all these sacrifices is to get seaports, not for the purpose of building up patiently and during a generation of years a commerce of their own, but of being in a position to threaten, cripple, and seize upon ours. If the mercantile community, the artisans and working men generally of this country, could only once get to understand that, I think we should be in a more secure condition. In sketching the outcome of the Franco-Chinese War, I passed over very briefly the possibility of a Franco-Russo alliance, but still I referred to it. I passed over it lightly because in the present unsatisfactory condition of politics in France, and the unfortunate position of affairs for that country in Tonquin, I did not think it right to criticize too severely, or to throw stones at our neighbour; but it was impossible not to say a few words to show that at any time a Franco-Russo alliance is quite within the range of possibility. I firmly believe that if the Tonquin Expedition had not turned out as it did, if everything had gone smoothly, and if M. Ferry's brilliant ideas regarding a French Indo-Chinese Empire had met with anything like the success that he anticipated, we should undoubtedly have had a Franco-Russo alliance, and we should have had that alliance actively engaged against ourselves. When matters were so critical between Russia and ourselves last spring, I had occasion to be in close contact with Chinese and Japanese statesmen at the time, and I have every reason to believe that M. Ferry did then contemplate such an alliance. I need hardly point out the exceeding danger that would lie in our having to deal with Russia in the West, not only in having to strengthen and defend our north-western frontier in India, in order to keep that Empire secure against Russian menace or attack, but in having added to that another Western Power, a potential enemy on our eastern flank. However, recent events which have occurred in Burmah, the occupation of the country and the masterly manner in which Lord Dufferin has dealt with the question, have removed, I believe, that imminent danger of a Franco-Russo alliance.

The CHAIRMAN: I am sure you will all agree with me in offering to Mr. Colquhoun our warmest thanks for the instruction which he has communicated to us this afternoon.

SPECIAL LECTURE.

Friday, November 13, 1885.

GENERAL THE RIGHT HON. VISCOUNT WOLSELEY, G.C.B., G.C.M.G.,
Adjutant-General of the Forces, in the Chair.

SUGGESTIONS FOR THE ADOPTION AND ADAPTATION OF THE SINGLE BARREL MACHINE-GUN FOR THE VARIOUS BRANCHES OF LAND SERVICE.

By Major M. R. WEST, R.H.A.

I TRUST I may not be considered presumptuous in taking up so large a question, but my reasons for so doing are my sincere belief in the great undeveloped power and value of the machine-gun for land service; that there has been already too much supineness in the matter; that no more time should be lost; that "forewarned should be forearmed;" and my heart-felt desire to in any way bring to the front and develop the efficiency and latent resources of the Service, and get the greatest possible power out of each branch, and thus add to the power of the kingdom. I also think that it would be highly culpable and unpatriotic on our part not to have developed every resource to have our Army as efficient as possible at all times, and before the breaking out of what must be a great struggle, instead of at the last moment having to rush into the adoption and adaptation of machine-guns, the value of which has been admitted by many of our most experienced and successful Officers. The French in 1870 found this difficulty with the mitrailleuse, a weapon which, even under unfavourable circumstances, did terrible execution.

Speaking without partizanship, as my only object is that the Service should be supplied with the best weapon in every way, I merely mention that since September, 1880, when I saw some experiments being conducted at the Royal Arsenal, Woolwich, by Captain Gardner, I have always believed in the value of machine-guns, and recognized at once a marvellous increase of power to each branch of the Service. With regard to Captain Gardner's single barrel, I do not think it can be excelled for simplicity, accuracy, and portability. But any weapon adopted should fire ordinary small-arm ammunition.

I do not feel the least daunted at the amount of prejudice to be overcome, or at the various difficulties and objections that will be raised by even intelligent and experienced Officers of all branches of the land service, but, with respectful deference to such, I believe the machine-gun should be adopted for artillery as a powerful auxiliary only (including horse artillery and field batteries, and garrison artil-

lery), cavalry, and infantry. I advocate the single barrel, believing it to be the best for mobility, simplicity, and efficiency, and that (we'll take the single barrel Gardner, as I know most about it) a single barrel capable of firing from 200 to 300 rounds per minute would be a better weapon than any other in not exhausting ammunition unnecessarily, or putting two or three bullets into one man or horse. At Ulundi there were many proofs of this, on examination of dead Zulus.

As to the objections that will be reasonably raised, the chief I imagine will be the additional weight, and that it would be quite impossible to make anything like effective practice at a halt from the breathing of the horses, and on the move from jolting and unevenness of the ground. With regard to the additional weight of machine-gun and ammunition, I do not think it at all insuperable, and that the additional power obtained would more than compensate: say, gun and 1,000 rounds, on foot-board of limber, 200 lbs. Two machine-guns on flank limbers would be of immense value, and in covering a retreat could be worked together, as a division of a battery, and check an enemy pressing on. They would be able to fire at the halt much longer than could be safely done by the field gun itself, and in moving at even a gallop would still be able to keep up a continuous fire. As regards the accuracy of fire at a halt, I do not think it is worth while now going into it. As to firing on the move, I do not think there is any more reason against it than a man-of-war suffering from the motion of the sea firing at a moving target, and naval Officers will tell you that they can cut a flagstaff pretty frequently with a 10-inch gun at 1,500 yards. Again, it is not the true aiming so much that makes the accurate shooting with a moving or movable weapon, as firing at the absolute right moment, as I have seen exemplified at revolver practice. In firing off a carriage on the move the hand and eye must work together; but practical results are the only thing to decide this question. Thanks to the courtesy of Colonel Nairne, Commandant of School of Gunnery, Shoeburyness, I have had the opportunity of firing off a limber, on the move and at the halt, and from the results am satisfied of the practicability of the scheme. On the sands, having for objects targets with a front of 24 yards, and three rows of infantry dummies, 50 yards apart, and 3 to 5 yards interval between dummies, out of a total of 70 shots at halt, smart "trot," and "gallop," 15 bullets were put in, 3 and 2 respectively in two rounds of 10 each (at infantry dummies), and in one round of 10 at targets, four hits when going at a smart trot.

For field artillery (including horse artillery and field batteries) I propose a single barrel, adapted as now suggested, to be used on and fired from gun limbers, and claim that it will almost totally do away with necessity of escorts, thus rendering field artillery more self-reliant and independent, that the fire from a machine-gun would be a very valuable supplement to shrapnel fire, and would altogether alter the hitherto incontrovertible fact that artillery as an arm was useless when limbered up, whereas now it can prove "Nemo me impune lacessit."

FIG. 1.

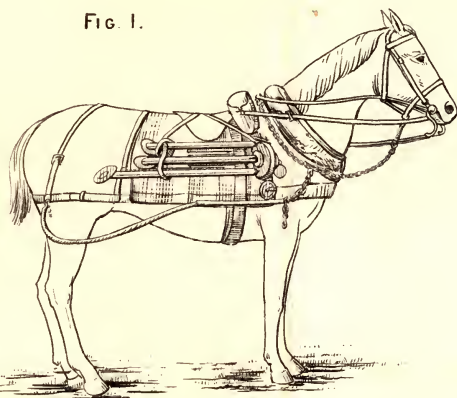


FIG. 2.

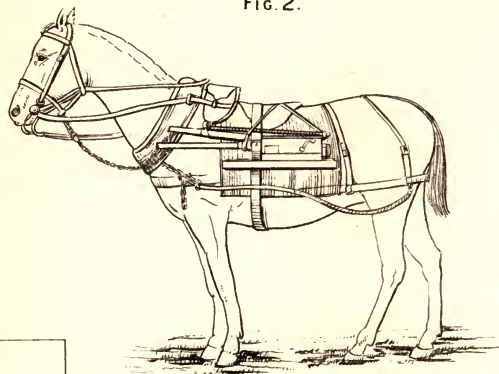


FIG. 4.

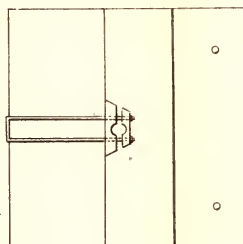


FIG. 3.

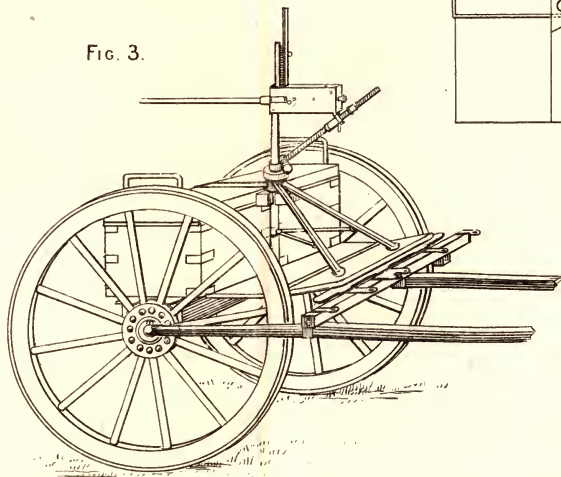


FIG. 5.

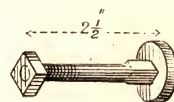


FIG. 6.

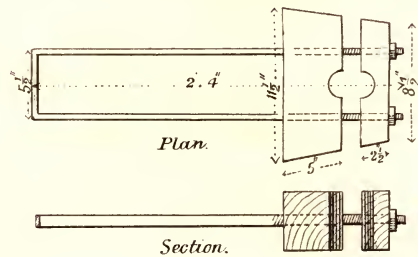


FIG. 1.

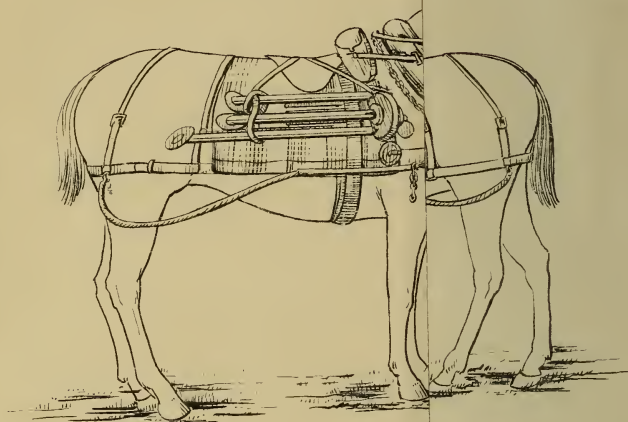
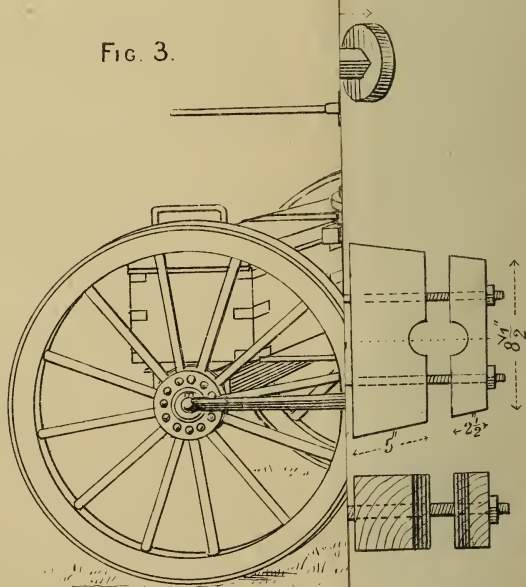


FIG. 3.



Garrison Artillery and Royal Engineers.—As to garrison artillery, the value of machine-guns for flanking of ditches must be obvious, but I would suggest their being also brought in conjunction with Royal Engineers, to the assistance of the latter, say, where a fort may have been constructed in an injudicious position, and that machine-gun stations should be constructed on commanding headlands and promontories, to keep down the fire of the machine-guns from tops of hostile ships, and more than counteract their effect. I have in my mind's eye Fort Camden, Cork Harbour, the fire from which, owing to the present position in which the guns are mounted, is masked so far as any effect it would have on any ships coming up along the eastern coast. Had the fort been constructed on one of the headlands to the south, and nearer to the entrance to the harbour, the fire of all the guns would have been thoroughly effective on any shipping that might approach.

Under the present construction of the fort, as the only three 10-inch R.M.L. guns which could be effectively used are *en barbette*, the gunners serving them would speedily be knocked over by machine-guns from tops of hostile ships; it is therefore very desirable that this should be obviated as far as possible. If machine-guns of 0.450 were useless, the Hotchkiss 6-pr. quick-firing gun would be very effective.

Landings.—Machine-guns would be most valuable in resisting landings, and should be able to do so successfully; from the other side they would be also valuable in covering landings.

Cavalry.—With cavalry, say two machine-guns per squadron would be a wonderful increase of power, and would prove invaluable for outposts, detached posts, advance and rear guards, for holding defiles and bridges, also in attacking the latter, clearing and holding streets, and in the hands of an enterprising, intrepid leader, and one ready of resource, there is no knowing the influence a small powerful force might have on the results of a campaign, from being able to paralyse the efforts of the enemy's cavalry to obtain information, and being able to seize and hold valuable detached and advanced positions. Colonel Wardrop's work near Gubat was a specimen of what can be done by an enterprising, intrepid leader.

Occasions, too, might arise where all the machine-guns of a regiment could be massed together, and form a battery.

No doubt objections will be made that our cavalry is already too complicated in equipment of arms, with lance, sword, and carbine; but again I assert that the additional power will more than compensate, and give great self-reliance and independence. I advocate the pack both for gun and ammunition, and believe that artillery (horse artillery and field batteries) and cavalry will most benefit by the judicious application of machine-guns; my reason for so saying is that their mobility will enable these branches to more quickly concentrate and take advantage of the increased power.

Infantry.—As an artillery Officer, I feel a great amount of diffidence in approaching the subject as regards the application of this power to infantry, more especially when there are so many Officers who, from their skill and experience, are so much better qualified in every

way to give an opinion; but, in my humble opinion, the machine-gun must be a most powerful auxiliary, and for minor movements would to a great extent render infantry independent of artillery, though in large campaigns it would have to give way to artillery proper, owing to the greater range of the latter.

In all campaigns, whether against a semi-barbarous or civilized foe, a free use of this weapon should, in the hands of a skilful commander, go far to revolutionize modern warfare.

The value of this arm for outposts holding detached posts, defiles, bridges, attacking the latter, and for street fighting, would be very great, and in extended movements for holding positions should by a judicious cross-fire be able to render positions impregnable, and in attacking positions by a continuous well-directed fire should do much to demoralize and shake the courage of an enemy.

Knowing I have the sympathy of Lord Charles Beresford, R.N., in this matter, I take the liberty of quoting from his lecture, at p. 942, No. CXXVII, of the Journal of this Institution, as follows:—

“The Duke of Wurtemberg, in a description of the battle of St. Privat, says, ‘During the action of Ste. Marie-aux-Chênes Prince Hohenlohe, commanding the Artillery of the Guard, had collected 84 guns opposite St. Privat and cannonaded the French position with great effect, at first at 2,640 paces, and afterwards at 2,000 paces. About 5 o’clock in the afternoon the Commander of the Guard considered the enemy to be sufficiently shaken for him to risk an assault across the open and gently ascending ground. The 4th Brigade of the Guard (Kessel) first moved forward from Habonville in the direction of St. Privat in line of columns in two lines with skirmishers thrown out in front, and a quarter of an hour later the advance of the First Division of the Guard (Pape) commenced in the same formation from Ste. Marie-aux-Chênes, distant about 2,640 paces from the main position. Habonville is about 3,960 paces, therefore the three brigades came about the same time within the effective reach of the enemy’s fire. The front of attack included little more than 2,000 paces, so that there were about ten men to the pace. This was, however, the closest formation of attack employed by the Prussians in the campaign.’

“The effect of the enemy’s fire even at a distance of more than 1,500 paces was so murderous that, according to the accounts received, nearly 6,000 men fell in ten minutes, and the advance had to be immediately discontinued.” If the fire of the mitrailleuse batteries was so murderous, it surely must be worth our while to adopt and adapt a weapon which will produce a similar murderous fire without sacrificing our field artillery as the French did theirs to the mitrailleuse batteries.

The Central London Rangers have been setting us an example in using machine-guns, and, doubtless, they will soon form part of the equipment of many enterprising Volunteer corps, and will add much to their efficiency.

Adaptations for 9-pr. Limber.—The long leg and stay of the Gardner tripod being taken off, its place is taken by a three-sided piece of

flat iron, fitted to go round centre box of gun limber; on the ends of the long sides of these pieces of iron, which are rounded, there are threads to take nuts, a piece of wood with holes cut through is slipped on these ends, this piece of wood being of the size to bring the socket of gun into an upright position, another piece of wood is slipped over ends, and nuts, then screw the arrangement tight, the two short legs are then screwed to the footboard; in this position the limber boxes can be opened when the gun is in a central position, and gun can be fired all round.

Adaptation for Cavalry or Infantry.—With an ordinary artillery shaft horse and harness, two horse sheets, a little pack thread, and two straps (each in two pieces), I adopted an expedient which did very well; the sheets were folded and attached over the horse's back and along the flanks to save horse's flanks from friction of pieces of gun; the barrel of gun is put through shaft tug on near side, and the socket of tripod through tug on off side; belly band of shaft tug is then fastened, and the two straps referred to put diagonally as stays across pad from near shoulder to off quarter, and from off shoulder to near quarter, when the gun and tripod were found to travel very well, and weight pretty evenly distributed.

Cavalry would use horses, and infantry mules or ponies, or even men, for transport of gun and ammunition.

The adaptations suggested by me are the most simple and of the rudest and cheapest description with means at hand, but when the machine-gun is adopted for artillery and cavalry, doubtless the socket will be let into a cylinder between the limber boxes, cylinder being on axletree bed.

For cavalry and infantry a very efficient simple pack could readily be devised, merely bearing in mind that the various parts should be as close as possible to horse's flanks, and nothing projecting unnecessarily, to enable animal to be brought readily through thickets and wood.

I shall be only too pleased if these rough notes and suggestions may be the means of bringing into prominence this valuable undeveloped power, and thus enormously increasing the power, independence, efficiency, and self-reliance of all branches of the Land Service.

Captain Gardner's Experiments at Berlin.—Captain Gardner some time ago having been requested to proceed to Berlin, did so, and on being introduced to the military authorities, proceeded to expatiate on the advantages of his gun, but was told that had they not thought it was the best, they would not have sent for him, and then desired to see some experiments, which accordingly were carried out, with one single and two double-barrel guns as a battery; the dummies at about 800 yards were set in motion by reels, with a view to seeing the effect on infantry attempting to take the battery, the result being very favourable to the battery.

The second experiment was at dummies representing cavalry, developing an attack out of a wood; this again was very satisfactory to battery.

A third experiment was at two pieces of fibrous wood, 16 inches square, at about 50 yards distance, pieces one behind the other, the result being that the front piece was cut through in 28 seconds, but some of the bullets having only penetrated into the second piece of timber, formed a foundation on which all the other bullets stuck; the German authorities were apparently pleased at the results of experiments.

Russian Government and Gardner Gun Company.—Some months ago the Russian Government were desirous for Mr. Norton, the late manager of Gardner Gun Company, to proceed to St. Petersburg, and within the last seven weeks, Mr. White, of the same Company, has been to St. Petersburg concerning this machine-gun.

Experiments at Maiden Castle, near Dorchester.—My first mounting of single barrel was on a T-shaped wooden frame removable from limber, being attached by three straps; it took half a minute to have gun off limber and on ground in action. The very first shot I fired from it was at 100 yards, at an ordinary 6' × 2' target; I aimed to strike about 3 feet from the ground, which it accordingly did; I then took an envelope I happened to have in my pocket, plaistered it with mud, and stuck the centre of envelope on the mark made by bullet, and, without looking over the gun, fired, when the envelope was struck. I repeated this with another round with like result, and then was satisfied as regards mechanical accuracy and recoil; on other occasions I fired up to 800 yards, and allowed non-commissioned officers, gunners, and some Volunteers who happened to be on the range, also to fire, and always with good results.

Opinions.—I desire to draw attention to the opinion expressed by our distinguished Chairman, of the "enormous future of the machine-gun in the field," stated at p. 482 in No. CXX of the Journal in these words:—

"I quite agree as to the value of the machine-gun in the field. I believe there is an enormous future for it, for the very reason that it will increase the effect, and will aid in the power of long-range infantry volley-firing. The machine-gun will take the place of considerable bodies of men, and when supplied with plenty of ammunition, which it is the duty of those who have charge of an army to provide, I believe there is a very great future for the machine-gun, and that that General or that nation which knows how to develop and make use of it will in the future have a very great opportunity—an opportunity that has never been made use of by any one before."

Also to the opinions of Officers of different branches of the land service, quoted in the valuable and interesting lecture given by Lord Charles Beresford, R.N., entitled "Machine-Guns in the Field," which is printed in No. CXXVII of the Journal.

A Colonel commanding an infantry regiment in India writes as to the use of machine-guns:—

"They could on all occasions be used as an escort for artillery. The conditions of modern warfare necessitate that the assault on a position must be preceded by a heavy artillery fire, sustained almost

up to the moment of actual collision. It follows, therefore, that for the proper and effectual performance of this duty the artillery must move well away and act from a flank, as no infantry in the world will stand artillery firing over their heads for any time. This being so, necessitates the employment of a large escort, and there can be no doubt, if you could move infantry about quick enough, it is the best of all arms for such work. You cannot transport infantry with sufficient rapidity, and therefore in most instances cavalry takes the duty. Now if you can mount and move machine-guns as fast and over the same ground as artillery, what better escort could they have, as, to all intents and purposes, they would have always on their exposed flank as many infantry as may be considered necessary? Before moving into position, of course cavalry would have closely reconnoitred and searched the ground selected for the massed artillery to act from; but once having done this, they could safely leave the artillery protected by the machine-gun, and be free for other employment on other portions of the scene of action. Had there been a couple of 10-barrel Nordenfelt guns with the artillery at Maiwand, the guns would never have been lost, the cavalry would never have been kept so many hours inactive under a heavy artillery fire, and the day would have been saved." He goes on to say:—

"With cavalry and mounted infantry machine-guns would be invaluable. Cavalry, to be of any use, must, in an enemy's country, be a long way ahead of the infantry and the rest of the army, and this distance is only limited because cavalry is not a self-contained arm. With two 10-barrel Nordenfelts (Plate XXIX, Fig. 1) permanently posted to each regiment, which can manœuvre and move with it, how economically yet how enormously has the power of cavalry increased! It has practically always with it 150 infantry who can be brought into action at any moment, and not a single man has to dismount. They are all in the saddle ready to complete any advantage gained by their machine-guns.

"Fancy the advanced cavalry of a large force armed as above working against an enemy's cavalry having no such adjuncts. The result is obvious, and the force with the adjuncts would assuredly penetrate the enemy's cavalry screen, get at the main body and hurl it back on to its infantry, a disordered mass. I think few will contend that a brigade of cavalry of three regiments with 6 machine-guns, representing 450 infantry, would not overwhelm a much larger force without machine-guns. Both sides would naturally be provided with horse artillery, but being of necessity without artificial cover, I maintain that you could (ground being favourable) work the machine-guns up to within their own range of such artillery, and they would, as infantry would do, drive them out of the field.

"To me it appears as if cavalry is the arm which will profit most by the introduction of machine-guns. It will, to them, supply a long-felt want, and will render them a self-contained force . . . Being infantry without nerves, they will find a happy home and a welcome in this portion of an army.

"It seems to me that these guns are bound to be an all-important

factor in deciding the result of the next big European war; and the nation which employs them, and thoroughly understands their technical working and organization, will assuredly come off victor. The result will be, if anything, more electrical and startling than the defeat of the Austrians by the Prussians in 1866: a fact which was entirely due to the superiority of an indifferent breech-loader over a good muzzle-loading rifle."

A Colonel of Artillery gives his views as to the use of machine-guns as adjuncts to batteries when escorts are not available:—

"A machine-gun to be of any use for this purpose must be able to manœuvre at the same pace as the battery which it supports. With mountain and heavy batteries, whose pace is a walk, this is perfectly possible by carrying the guns on pack animals. To batteries of this class I think they would be valuable auxiliaries (Figs. 2 and 3).

"For mountain artillery they would be specially suitable. They would greatly increase offensive and defensive power at ranges from 100 to 1,500 yards. Their chief use would be the defence and attack of defiles, the defence of small fortified posts such as we held in the line of communications in Southern Afghanistan, and in repelling attacks at close quarters, as at Ahmed Keyl and Maiwand. There is the more reason for their use here, that the shrapnel fire of these batteries is weak.

"For horse and field batteries the problem is more difficult. No toy carriage with small wheels can be relied on for transport purposes. Such a carriage can be used and should be used as a fighting carriage for a machine-gun in the same way as it is used in the mountain artillery. If, however, a very light gun with a good tripod arrangement, such as the 3-barrel Nordenfelt, were introduced, it is possible that the tripod might take the place of wheels, since both gun and tripod can be carried about quickly by the detachment (Fig. 4).

"The great difficulty of working machine-guns with horse and field batteries appears to me to be this: How can you transport them so as to be suitable for rapid movements under service conditions? It comes to this—you must carry them about on carriages and wheels which shall not be less strong than the other carriages of your equipment. No system of carrying them on our already fully weighted gun or ammunition carriages will answer. They must have a separate equipment, and this means an addition to the Officers, men, and horses of your battery. Unless this is conceded, it is hopeless to think of machine-guns as auxiliaries to field artillery."

A Colonel of the Royal Engineers says: "About the tactical employment of the machine-guns I have thought a good deal, and my strong opinion is, that if they are adopted they cannot possibly be attached as an integral part to either cavalry regiments, artillery batteries, or infantry battalions, and that they must either be kept in batteries by themselves (which would be the most satisfactory plan), or else be handed over to the Royal Engineer Companies.

"I cannot conceive their being permanently attached to Cavalry or Artillery without constantly hampering them, as it would only be on rare occasions that they would be required; on these occasions they

would always be available. Until they are made much more formidable than they seem to be at present, I do not see how they can possibly take the place of an escort for Artillery . . . There is a good deal to say in favour of their being in charge of Royal Engineer Companies. They could thus be introduced without an increased establishment, and consequently expense, except for home, as at the times when they would be required for action, sappers would usually be unemployed in the reserve, and could spare the gun detachments necessary to work them. Also it seems to be universally admitted that whatever the value of the machine-gun under other circumstances, it is without doubt specially suited for flanking the ditch of a fort, and for other employment in connection with defensive works, and here there would always be sappers available to work them. I am aware that at times, especially in offensive actions, every sapper is required for his own work at the front, but this work would very generally be the strengthening of a position, village, &c., just carried, and here the machine-gun in the hands of sappers might be invaluable."

Lord Chelmsford writes: "On the advance to the relief of Ekowe, two Gatling guns accompanied the column, and at the battle of Ginginhlovo did considerable execution amongst the Zulus *at the opening of their attack*, which commenced on the north side of our position. The Zulus very soon, however, worked round to the west and south side of our laager, and the Gatlings were not in action therefore for any length of time.

"At Ulundi we also had two Gatlings in the centre of the front face of our square. They jammed several times in the action, but when in work proved a very valuable addition to the strength of our defence on that flank. Machine-guns are, I consider, most valuable weapons for expeditions such as that which we had to undertake in Zululand, where the odds against us must necessarily be great, and where it is necessary to leave small detachments in charge of posts along the line of communications. The Gatlings, however, required too much care in firing, and could not be entrusted to any but skilled manipulators; if a machine-gun can be invented that may safely be entrusted to infantry soldiers to work, and could be fired very much as one grinds an organ, I am satisfied of its great value. They should, however, in my opinion, not be attached to artillery, but should be considered as essentially an infantry weapon, and should be worked by infantry soldiers; so utilized, they might, I feel sure, be used most effectively, not only in defence, but *in covering* the last stage of an infantry *attack* upon a position, where the troops have at last to cease firing and endeavour to get home with the bayonet."

Colonel Methuen, C.B., recently returned from Bechuanaland, telegraphs on morning of 13th November:—"Regret letter only just reached me. I often thought the value two or three machine-guns would have been, concealed in the wagons of a long convoy. In event of fighting I should have had to use your convoy escort, say four troops at some distance from the wagons, and these would have been left unprotected; this would not have been the case had the convoy carried some machine-guns such as you describe."

Colonel Wardrop telegraphed:—"Regret absence from town; am strong advocate for machine-guns; with cavalry quite invaluable; consider must be armament of the future; glad you are ventilating this."

The CHAIRMAN: My lords and gentlemen, I think this subject is one that specially deserves and merits discussion, and I hope there may be a very useful and interesting discussion upon it. I would remind you that the subject is really the uses of machine-guns generally, and that there is no desire, as far as I know, on the part of most of us, to discuss the relative merits of various descriptions of machine-guns. We do not at all wish to go into the question whether the Gardner, the Hotchkiss, or other gun is the best, but to discuss the uses of machine-guns and how they can be best adapted and made use of for tactical purposes in the field.

Lord CHARLES BERESFORD: My lords and gentlemen, it is extremely gratifying to those who take an interest in this question to find an Artillery Officer coming here to put forward the views we have heard this afternoon. There are a few points mentioned in the paper that I should like to touch upon. First of all, as to the question of the single-barrelled Gardner gun; for myself, I think the single-barrelled gun is not so good as the three- or five-barrelled gun, and at the same time it is of almost the same weight as the three- or five-barrelled Nordenfält. I am not going into the question of which is the best gun, but I think the volley has an important advantage over the single bullet. With an enemy approaching you or in attacking a position that you wish to occupy, it is better to have a volley-firing gun than a single-barrelled gun, and, besides, the volley-firing gun has a horizontal action which does not jam so easily as the rotary-motion gun. Major West also made a remark as to the question of firing the gun from the limber, saying that it was easy to do it. I entirely agree with him in that proposal, because I always find on board ship that with a little motion we make better practice, especially if the platform the gun is on, is moving; you get your sights on quicker than you do if the ship is stationary. Major West also made a remark as to the question of using these guns against harbours and ships, or on a headland. I entirely agree with him, only I am not quite sure that the shell-gun would not be a better gun, because the shell-gun is an actual and practical range-finder. A small machine-gun like the Hotchkiss, of which they have large supplies in the ships of foreign nations, is a range-finder at a moment, whereas we have nothing of the sort. We have to fire our big guns to get the range. Every artilleryman on shore who is attacking a ship coming in, knows that the great thing is to get the range of the ship as quickly as he can. I therefore think the shell-gun would be better than the rifle-calibre gun for their purpose. Their use for resisting landings and also for landings was very well exemplified by the bombardment of Sfax, which was taken by the French sending their launches and pinnaces with the Hotchkiss 1-lb. shell-gun. They had placed the electric light so that it made two arcs on the shore; the boats advanced on the dark portion of the water; they got close to the town, and Sfax was actually taken with the Hotchkiss shell-gun. We have no gun in our Service that we could have done the same thing with. Major West made a remark about guns being attached to cavalry. Of course for a sailor it would be most impertinent to say what the gun should be attached to. The point I have always advocated is, that the gun is useful. Whether it is mounted on a galloping carriage, so as to be attached to every branch of the Service or to one branch of the Service only, is not for us to say, but what we do say is, that the gun, under many circumstances, is of the most useful character. I should certainly back up what Major West said as to holding streets, because we remember very well that, after the bombardment of Alexandria, a very small force was landed, and it was mainly due to the machine-guns that that force was enabled to clear the town and get things in order. Major West also called attention to the effect of the gun when it was used as described by the Duke of Wurtemberg. We must remember what that gun was and did. It was a very bad gun, it had bad ammunition, was very lumbering, and was treated as a gun, and one of the reasons that this gun has always been objected to by the Royal Artillery is that it is called a

gun, whereas it is not, a gun, but merely a cluster of rifles or a single rifle that has the power of what has been described as a company of men in its efficiency and in what it can do. Major West said that he did not care which gun should be brought into the Service as long as the efficiency of the gun was recognized. I certainly agree with him in that. I think our noble Chairman has given his very strong opinion on the question, and the sooner the country will take it up the sooner we shall get an arm which may have a most important future in future wars.

Major-General W. LAURIE: My lords and gentlemen, I had not intended to speak, but as no one else seems desirous to do so I may be allowed to say one or two words, seeing that we had in the North-West rebellion in Canada last spring a little experience of machine-guns. As soon as that rebellion broke out the Minister of Militia, not being able to get any other machine-gun, and not being able to communicate with Admiral Commerell, who has since intimated to me his great desire to have sent a Naval Brigade with us, telegraphed to the States in order to get some of the only guns that were available, namely, the Gatling. I was first of all with General Middleton in the advance, and there I was struck with the desirability of having guns of that description with the advance guard. I really think that the lecturer has not sufficiently emphasised the great importance of machine-guns being employed with infantry, and especially to an advance guard searching the country. The American Officers with whom I came in contact, and who had had experience in frontier warfare, told me that they found the machine-guns most useful, enabling them to stop the column, and to search under brush to the front or flanks, and that the use of these weapons saved a great deal of delay, and also exhaustion to the light troops covering the advance, because a few hundred rounds of Gatling ammunition poured in with a good spread effectually searched any smallwood that was in the way. I must differ from the lecturer on one point, because I believe that what we want is very rapid firing. One Gatling that we had fired 1,200 rounds a minute, but the other Gatling only fired 800 rounds. We had to take what we could get ready made, for we wanted to suppress the rebellion as quickly as possible. I believe that the most rapid firing would be the best. I feel satisfied that a few hundred rounds fired into a copse would clear it of scattered parties of such men as we were likely to come in contact with, such as Indians or other barbarous tribes; they would be sufficiently impressed with 500 or 600 rounds coming in very rapidly amongst them with a fair spread horizontally and vertically, and would clear out, and there would be no necessity to halt the whole column, and send a body of troops for the purpose of turning such a copse as that, thereby delaying the whole advance. I may say that our Gatlings were not used for that purpose because we could not get them up in time. General Middleton was determined to get at his enemy as soon as possible. As soon as I returned to the base and took charge, I pushed forward the Gatlings, but unfortunately he did not receive them during the advance, although they came up in time for some of his fighting. On one occasion it was reported that the Gatling did exceedingly good service in saving a couple of guns of the Canadian Artillery. These guns were being rushed by a party of half-breeds, but the party in charge of the Gatling brought it up and met the attacking party full in the face; so that the Gatling acted as an escort to the artillery and drove back the attacking party, who would probably have captured the gun. But I only give this from hearsay, as I was not present. Of course using the guns in the way that I speak of, to search the country in advance of the column, would necessitate an enormous supply of ammunition, but that point I am satisfied was not sufficiently grasped by those who in the first place ordered our Gatlings, for they gave us only 20,000 rounds, and as soon as I took charge of the base and examined into the quantity of supplies of food and ammunition available, I applied for more Gatling ammunition and was asked in reply, "What do you want with more ammunition? You have 20,000 rounds for two Gatlings." I answered, "Yes, I have just enough for ten minutes' firing, and I should like to have at least enough for a second engagement of that length." It took over a month before we could get an additional 50,000 rounds, but, as the ammunition supplied to the Gatlings was similar to that which our mounted police were using, we were able to fall back upon that to a certain extent. I simply wish to record the experience of the American Officers, because,

going to work as we expected we should have to work, we wanted to get all the information we could about Indian warfare. I therefore lost no chance of hearing from those who could speak from personal knowledge, and they were strongly in favour of the use of machine-guns. I believe they are capable of rendering good service for escort work as the lecturer has told us, but I urge their employment in the way I have stated, although I am aware there will be a large expenditure of ammunition; for even putting aside the strategical advantages of a rapid advance and early arrival at the objective point, and dealing with it simply as a question of transport, my recent experience of the enormous quantity of supplies daily consumed by a marching column, and the difficulties of furnishing those supplies, satisfies me that it is most economical, as a financial and transport question, to expend a few thousand rounds of machine-gun ammunition daily, and thus save a large amount of the wear and tear of flanking and search parties, and delay in the advance of the column, and thus shorten the number of days required to accomplish a march. It is much easier to transport the additional ammunition than the additional provisions for men and forage for horses required for the extra days which the force would take to accomplish the distance if delayed, whilst the country was being searched by infantry.

Admiral ARTHUR: My lords and gentlemen, I must apologize for taking any part in the discussion of this subject, which is chiefly confined to the land services, but after all it is a practical question, and we cannot start any abstract theory upon it. What we want is to know the experience that has been gained in action, and possibly the Navy has handled machine-guns more in action than any other branch of the Service. I wish to support Lord Charles Beresford's view as to the value of the machine-gun as a range-finder, but I must say I do not agree with him in confining it to the shell machine-gun. As a matter of experience I may state that at the last firing I had in the "Hector" we used the machine-gun for that purpose, which, by-the-by, was a four-barrelled Nordenfolt, and we never had better firing from the heavy guns, the range being very accurately given by the man stationed at the Nordenfolt, who was ordered to fire at a slow rate, one shot a minute, and to report the elevation which he used on each occasion; we found by watching the fall of the projectile that we thus got the range within a few yards. The practice of taking an angle at the masthead is very uncertain on account of the want of skill of those stationed there, as you cannot always spare a Lieutenant or an experienced Officer for that purpose; besides, it is very difficult to use a sextant when there is much movement on the ship. The value of a range-finder afloat is incalculable, it will no doubt be also found very valuable on shore, and I do not think that we have as yet got a range-finder so absolutely perfect that the machine-gun might not be found very useful for that purpose.

General SMYTHE, R.A.: My lords and gentlemen, I have only one remark to make, as I have not come prepared to go exhaustively into the matter. I may say that whilst we all admire very much the powers of the machine-gun we must remember all the time the serious difficulties which accompany its action in the open field. As Lord Charles Beresford has correctly described, it represents a cluster of rifles, that is, infantry rifles, and its range is the range of the infantry rifle. To bring it into effective action it must come under the range of the infantry rifle; and the problem is how to get it there against a well-trained infantry. When that problem is solved, no doubt the effect will be wonderful, but at present it is beset with difficulties; and Artillery Officers, who generally set sureness of hitting in the first place, are hardly prepared on such a sudden, and, I might say, with great deference to the lecturer, such a vague recommendation of the effects which he has realized, to accept the novelty of shooting from a carriage passing over rough ground at speed. I have no doubt myself the whole question lies in that, how to get this very powerful cluster of rifles within reach of other rifles which are not so hampered by weight and unhandy machinery.

Colonel MARKHAM, R.A.: My lords and gentlemen, agreeing as I do in every way with what Major West has said as to the value of machine-guns, and with what General Smythe has just remarked, yet I think it is a great question whether you will get accurate shooting moving over rough ground, and also with a machine-gun mounted on a limber; it is a question whether you will obtain accuracy of shooting, because, I believe, the jolting of the carriage would cause so much friction on the

screws and parts of the limber, that eventually there would be a certain amount of play, and the result would be that the guns would have inaccuracy of shooting. I think if the machine-gun is attached to the artillery at all, it should be on a separate carriage. Of course that becomes a matter of expense. I imagine that Major West advocates putting it upon a limber for that very reason, to save expense, but I think you can hardly work the two things together. I think that both the driver of the gun-carriage and the gunners would not quite know which was their proper weapon; the actual gun on the gun-carriage or the machine-gun on the limber; and, therefore, it would be far preferable if it were on a carriage by itself. With regard to attaching the gun-carriage to cavalry, and carrying it in the way proposed by Major West, I did not quite understand how he intended to balance it, and if it were not properly balanced, I think it would be very apt to give the horse a sore back. I would further mention that I do not quite understand the carrying of the ammunition when the machine-gun is attached to the artillery. As the limber-boxes and ammunition-boxes on the wagons of the artillery now stand, I am quite sure they are packed full enough, and it would necessitate additional carriage for the conveyance of the ammunition for the machine-gun.¹

Major WEST, in reply, said: With regard to the question as to whether the gun should have one, three, or five barrels, those who have had greater experience than myself are much better able to speak, and the suggestion that we should have very rapid firing for the purpose of searching a copse is a very excellent and practical idea. No doubt the 6-lb. Hotchkiss quick-firing gun would be most invaluable for the purpose of mounting on promontories and the protection of harbours. I do not find fault in any way with that gun, which, indeed, is a very much more powerful machine-gun than any which we have at present. Coming to my own branch of the Service, I do not quite understand why General Smythe said that the machine-gun must come under the range of infantry fire, because there you have a weapon, accurate up to 2,000 yards, which will fire much more accurately than riflemen, because it has no nerves, and it only requires one good man to work it. Of course, if one man comes to grief, you have trained men ready to take his place, and, therefore, I say that it is better than the infantry fire. Then General Smythe speaks of the difficulty of getting it within range. Now if we are always trying how not to do things instead of trying how to do them we shall never arrive at anything, and my idea is that we should open up the question, and then let us come to some trial to see what we can do with it. I say this with the greatest respect, but I do think that we should show some energy in trying to get this question solved in some way or other for the land service, instead of letting it drift on, as it has been drifting for so long a time. The only way to solve the problem is to try to work it out. I am excessively sorry that it should be considered a very "vague novelty," but that is, of course, a matter of opinion and—I say it with the greatest respect—I think it is a great mistake that we should always stick to the old thing when we might get something better. I say distinctly that the machine-gun is not an artillery arm, but it is a powerful auxiliary to the artillery. Colonel Markham speaks of the jolting and the friction that are likely to arise. No doubt that is so; but then we must look to all these things. If a thing gets out of order by jolting and friction and that sort of thing, we must see to it; let the wheeler² examine the adaptation every day after drill the same as he would examine the gun-carriage. Do not let us give up the whole thing simply because some little difficulties arise, but let us do something and try and make something out of it. Then

¹ I would add that Major West has not described how the machine-gun, packed to accompany cavalry, was to be brought into action. It is presumed the horse would be led, and a certain number of men told off to dismount and work the gun; but it appears to me that this would be a longer business and less practicable than conveying the machine-gun into action on a carriage specially adapted for it, which would also convey the ammunition. As the machine-gun would be chiefly used for defensive purposes, it is a necessity that it should be arranged to be quickly brought into action and also out of action, and I conceive that this could not be rapidly done if carried on a pack-saddle as proposed by the lecturer.

² Each battery of field or horse artillery has such an artificer called a wheeler.

as to inaccuracy, no doubt there will be inaccuracy to a certain extent, but I say that instead of the guns being utterly helpless when limbered up, they will be able to show what they can do if they have these machine-guns to assist them. Let us try it on rough ground; there is no reason why it should not be tried; let us jolt and gallop and knock it about all over the place, but do let us give it a trial. Then with regard to not being able to do any shooting, why it is to be said that we could not do it off a limber when sailors do it off a ship and fire at another moving object, I do not see at all. As to the men not knowing which gun is their gun, the time when it would be chiefly used with artillery would be when the Gardner gun was supplementing shrapnel fire, or when the gun was on the move, and I do not see what difficulty there could be about that. With regard to the question of balance, when the gun is carried on horseback, of course I have only shown you the very roughest adaptation. I had the horses unhooked outside; the shaft-horse was merely taken out of the gun-carriage, the back-band was taken up a little, the muzzle of the barrel put through the loop of shafting on near side, and then run right up to the chamber, while the loop where the shaft goes on the off side was slipped over the pedestal or socket. One strap went round the long leg, bound the three legs together by their own weight, tightening up on it, and went across to the muzzle of the gun on the near shoulder; then there was one from the off quarter to the near shoulder, and these straps acted as stays. As to the sore backs, there were sore backs, but it is a thing that must be properly adjusted and tried. As to the balance, I had the thing weighed, and there is a difference of about 8 lbs.; but I say that this is the very roughest adaptation, and if people would set to work and try to make something out of it, I think they could do it. A very simple pack-saddle could be made, and then there would be no sore backs. I can see no difficulty whatever about it if you have a pack-saddle. As to the ammunition, my suggestion was that a thousand rounds could be carried without difficulty on the foot-board of the limber. Of course allowance must be made for reserve, but a thousand rounds with each limber would be worth something. I repeat that my adaptation is of the very roughest kind, and that I do not believe that the difficulties that have been mentioned are at all insuperable.

The CHAIRMAN: I am much disappointed, and I am sure most of those who came here to-day are disappointed, that the discussion has not ranged further on this subject, and that so few Officers have taken part in it. It is a subject, I think, especially for discussion, because the English Army has now most certainly arrived at the conclusion that we must have machine-guns, and I am very glad to say the authorities have at last decided upon their being introduced into the Army. But although I think it is to be much deplored that we have not had a fuller discussion upon the tactical merits of machine-guns in the field, still there are some points, I think, that we may congratulate ourselves upon with regard to this meeting to-day, and one is the fact of this subject having been brought before the Institution by an Officer of the Artillery. That I consider really a very great point to gain. I should be very sorry to say that any branch of the Service has particularly opposed or been obstructive to the introduction of machine-guns into the Army, but there certainly is a very common impression in the minds of a great number, that opposition from Woolwich has prevented our having in the Army any machine-guns for many years past. I am very glad to congratulate my friend Major West on having taken this subject up, and having come forward as an Artillery Officer to give us the benefit of his opinions upon it. I think also those present to-day are to be congratulated upon the fact of the presence here of Lord Charles Beresford, who has had more experience with these guns than most of us, and who is one of the very few Officers who has actually used machine-guns in the face of most serious attacks in the field made by an enemy charging home, not an ordinary charge of people coming up to you, but a determined enemy charging home into your square. I have no intention in his presence of at all repeating the story that has been so frequently told of how he at a most critical moment made use of machine-guns to such advantage as he did upon the return of those vessels from Khartoum, when I may say it was the machine-guns he had in his possession on board that day that enabled Sir Charles Wilson's party to come back in safety. I think I am justified in saying that had it not been for the machine-guns he had with him, the ship he

was on board of must have been wrecked, and most probably all on board killed or taken prisoners. It was simply, to use his own expression, by "pumping lead" into the embrasures from which the guns of the enemy were pointed against the ship that he was enabled to prevent their manning those guns, or of even running them out to fire them. One of the first questions discussed was the point of how many barrels there should be to these guns. I think it makes very little matter. Experience will tell us most probably which is the best. I rather agree with Lord Charles Beresford that they ought to have more than one barrel. I think the reason I should recommend more than one is, that in case one barrel got hot in firing, or that any accident occurred to it, or to its firing action, it would be a very good thing to have a second or a third barrel in reserve. I think that, quite apart from the advantage of being able to fire volleys from guns with several barrels, I should be afraid to rely entirely upon a single barrel. The use of machine-guns is really in its infancy, and as yet we have only used them upon a few occasions, Lord Chelmsford used machine-guns at Ulundi, and we have recently used them in the Soudan. However, whenever we have used them, we have thoroughly realized the advantages they give. We have recognized the necessity of having them with the army in the field, and by degrees when we have really decided upon the best equipment for them, we shall after a little experience over all sorts of ground be able to arrive not only at the best means of equipping them and carrying them in the field, and also of carrying their ammunition, but we shall then be able to decide how they can be best tactically made use of in action. As regards the range, General Smythe has referred to the almost impossibility of using machine-guns under infantry fire, and he has spoken of infantry fire as if it must necessarily be the limit within which you can use machine-guns. I do not quite agree with him there, because I do not attach such enormous importance to the very long range infantry fire from the shoulder, it must be always very inaccurate. But I feel convinced the fire of this small arm—because it is not a gun, it is a small arm, an infantry arm, it is not an artillery arm—I think the fire of this small arm, firing from a fixed carriage at ascertained ranges of 2,000 up to 3,000 yards and beyond, will be most effective. You have only to ascertain your range, and I hope we shall be able to do so by means of good range-finders, and then I believe you will render it almost impossible for any field artillery, offering as it does such a very large mark, to live under the amount of lead that can be poured upon any particular portion of ground that may be occupied by any arm of the Service. Of course the use of machine-guns from which a constant fire is to be maintained, whilst they are in motion over rough ground, presents a great difficulty, but for myself I attach importance to this weapon, not for the purpose for which the lecturer has brought it forward so much as for use with the infantry arm. I believe myself, as I have said before on a previous occasion in this hall, that the machine-gun has an immense future before it; that when intelligently made use of by an able commander in the field, its effect will be almost incalculable, and will revolutionize, according to my view of the question, our tactics generally. But using it from a fixed carriage whilst stationary is of course a very different thing from using it over rough ground on an artillery carriage when in motion, in the manner proposed by the lecturer. At the same time, I think there is not an Officer present who can look back to the various military campaigns he has read of, without remembering some instances where artillery, limbered up on the march and therefore quite defenceless, have not been taken by cavalry. Now had that artillery when charged in a hollow road, in the open, or in a wood, had one, two, or three of their carriages armed with machine-guns in the manner the lecturer has proposed, I think there is very little doubt that the cavalry would have been beaten off. Major West quoted Colonel Methuen about his experience with large convoys in South Africa. My knowledge of that country leads me to the same opinion, that if on every fiftieth or hundredth wagon you had a gun mounted as now proposed, no cavalry could approach them. The wagons so armed would in fact be a series of moving martello towers, and although the firing might not be so accurate as to hit a horse at 1,000 yards, still it would keep off cavalry, and no cavalry would charge home in the face of such a fire. I do not find there is any other point in the lecture that I have noted to remark on. I wish I had, through a wider discussion of the subject to-day, a wider field for my remarks, but

I am sure you will all agree with me in saying that we have been very much interested in the lecture, and that we are all very grateful to Major West for having brought this subject before us.

Mr. NORDENFELT, being called upon by the Chairman to explain his gun, said : My object in making a single-barrel gun was to see how light a machine-gun could be made that could fire quickly, and I believe this is as light as a gun could be made. I believe it is, if anything, too light. In order to fire 180 rounds a minute from one barrel, you want a mechanism which will act reliably. The feed is the ordinary feed, the same as for the many-barrelled gun.

The CHAIRMAN : What is the weight ?

Mr. NORDENFELT : It is 13 lbs. without the shoulder-piece ; about 15 lbs. altogether. But I am afraid I cannot advocate a single-barrelled gun ; I do not like it. I am under the impression that it is a great advantage to have more than one barrel. If you can make a gun within the computable weight for the purposes for which you require it, the more barrels you get into the gun the better. I do not know if I am out of order if I ask to be allowed to say a few words about the ammunition. One is carried away rather with the idea that if a gun fires 1,200 rounds a minute, you want 20,000 or 30,000 rounds actually on the spot. You want the ammunition very near you, but I do not think you want a very large quantity actually in front, because if a machine-gun has fired effectually a few hundred rounds into a copse, I think it has done its work for that minute. Although you may fire 1,200 rounds a minute at a fixed target at the very short range of 100 yards, I know that with the five-barrelled guns of any pattern we never get more than 170 rounds a minute aiming at a moving target. In the same way with the one-barrelled gun, instead of firing from 200 to 300 rounds, you only fire 50 or 60 rounds a minute aiming, and that I think is rather too little for the purpose of machine-guns. I am under the impression that you ought to be able to fire in a few minutes a tremendous number of rounds under given circumstances, and then you would move your gun and wait for a few minutes when the first firing had produced the desired effect. The mechanism of the gun is tolerably simple, and I believe that any single-barrelled gun would be very useful under certain circumstances where you are limited to very low weight indeed. But, as I have said, if you can get more barrels in the same weight, it is better. It is an advantage to be able to fire a volley : for instance, supposing cavalry suddenly come up to you turning round a corner or up a passage, you must aim now and then, and if you can fire volleys between aiming, you can discharge a greater number of shots than you would if you fired single shots between the aims. I am especially pleased that Major West, as an artilleryman, has taken up this subject, and I hope it will lead to what I consider most important to have, further experiments with machine-guns mounted in every possible way.

Friday, January 22, 1886.

CAPTAIN THE RIGHT HON. LORD CHARLES D. BERESFORD,
C.B., R.N., M.P., in the Chair.

MACHINE-GUNS, THEIR USE AND ABUSE.

By Captain R. H. ARMIT, 22nd Middlesex Rifle Volunteers, Central
London Rangers (late Lieutenant Royal Navy).

The CHAIRMAN: Gentlemen, I have the pleasure to introduce to you Captain Armit, of the 22nd Middlesex (London Rangers) Rifle Volunteers, who will read a paper on "Machine-guns, their Use and Abuse." The paper will be more interesting because Captain Armit and his Colonel, Colonel Alt, were the first two who have ever tried practically to use a machine-gun for drill purposes to show how it would be used in the field; in other words, they tried the first mounting for it. The paper I think from that circumstance will be very interesting to all present.

Captain ARMIT: My lord and gentlemen, as a retired naval Officer, upon joining the Volunteers I used my best endeavours to make our corps efficient, and with the support of my Colonel I have introduced into the Volunteers these guns. We have had experience of them for over four years, and before the war broke out in the Soudan we were enabled to point out, that which was ascertained in that war by practical experience, that the rifle-calibre machine-gun was valueless when mounted as a field-piece. It is to Colonel Alt that the credit is due of taking the lead in mounting machine-guns on magazine carriages; in fact, only this day the Director of Naval Ordnance was kind enough to inform me that that was the fact. Having studied this question ever since the war of 1870, when I was in the field with the German forces, I have taken the liberty of writing this paper, which I hope you will allow me to read, with that indulgence which you always accord to novices in this line.

THE adoption of machine-guns for military purposes has been much delayed by the absence of knowledge obtaining in regard to their use and capabilities. The failure of the Montigny, the first mitrailleuse used in warfare, so prejudiced the minds of soldiers against this arm, that notwithstanding the many improvements since introduced into this system of firearms, the military authorities of all nations have looked upon it with distrust up to the present time. The Gatling was invented before the Montigny, but only a few of these guns were used by the French during the latter part of the Franco-German war. They were about the same time introduced into our Navy, where they gave but little satisfaction. The Montigny mitrailleuse followed directly *after* the Gatling as follows: The Gatling having been invented and first tested during the American Civil War, was exhibited in the Paris International Exhibition of 1867, where Napoleon III took a great fancy to it, and ordered field tests with it. As it was then in an unperfected state, with a speed of fire of only 60 to 100 shots a minute, the French Commission made a semi-favourable

report. That is, they predicted a great future for machine-guns, and urged the necessity of immediate development, but condemned the Gatling as it existed. Since then other systems have been invented, and various types of those systems have been brought to the notice of the public. But to this day, so little is really known, both in and out of the Services, concerning the actual development of mechanically loaded and fired ordnance, that whatever the system or type used, they are generally designated as Gatlings or machine-guns.

Much uncertainty exists as to the real meaning of the term "machine-gun." It is applied to a magazine-rifle, a mitrailleuse, and a shell-firing piece of ordnance, without the slightest distinction. Nor does it appear to matter whether the arm spoken of has one or more barrels. Every description of firearm not actually reloaded by hand by the firer, that is to say, mechanically loaded arms not as yet used or recognized as belonging to field artillery, are now termed machine-guns. This is not only a grave mistake, but it also leads to false impressions being formed as to the relative value of the different types of machine-guns now competing for adoption in the Service. In the Army, nine-tenths of the Officers and men only know this arm, whatever its type may be, by the name of Gatling, the pioneer of all these guns. Few, very few, understand the mechanism of any of the types of which the Gatling is the generic system. It is therefore necessary, when dealing with this important question, to class machine-guns not only according to their types, but also according to the system they form part of. Nor should their tactical value and strategical importance be overlooked. Of the relative value of machine-guns, which are merely different types of the same mechanical system, little would need to be said (as they all use the same barrels and cartridges, and their performance must consequently be approximately the same) were it not for the fact that certain tests which, on but very slight reflection, must appear to all sensible men as utterly unfair, have been adopted to determine their relative efficiency. No man in his senses would now advocate the trial of the Enfield-Martini or infantry rifle against field artillery, with a view to deciding whether the Army shall in future be armed solely with rifles or guns. And yet, the machine-gun of rifle-calibre has been so treated in Russia, and the "Armeebblatt" has actually published a report that a Mitrailleuse-Nordenfelt has beaten the cannon-revolver Hotchkiss! But to speak of a machine-gun of rifle calibre as having established its actual superiority over a revolving cannon, firing explosive shells weighing 3 lbs., or other light ordnance of this rapid-firing type, is simply absurd. That there may, at times, under certain well-defined conditions, be a relative superiority in the lighter over the heavier of these guns, we know to be the case. Thus, for example, in defending a breach, a ravine, a bridge, or a road, the mitrailleuse is relatively superior to the shell-firing gun at close quarters, owing to the large number of rifle bullets it can fire in a short space of time. At close quarters this is a decided advantage, provided the guns are not put out of action by the chamber of one or more barrels being choked or jammed by unextracted cartridge-cases or from other

causes. This happened at Ulundi, El Teb, Tamaai, and Abu Klea. It has never happened with the larger shell-firing guns in such manner as to be a real source of danger to the gun, while a single unextracted cartridge-case will so choke the chamber of a Nordenfelt, Gardner, or Gatling rifle-calibre gun, as to render it impossible to clear the jamb for many minutes, during which time the guns, if in action, are liable to capture.

It was in the early part of 1880 that the Committee presided over by Admiral Boys commenced experimenting with machine-guns at Shoeburyness.¹ I called at that time on General Sir Frederick Campbell at the War Office to obtain leave to attend those experiments. Sir Frederick granted my request, but before dismissing me, took the opportunity of imparting to me his views on the machine-gun question. In Sir Frederick Campbell's opinion, twelve riflemen could deliver a more telling fire than any machine-gun, and yet every such gun would require more than twelve men to work it. The Gatling had proved a failure; there was no reason to suppose that the Nordenfelt could do better; in Sir Frederick Campbell's opinion, the only machine-gun of any real utility was the Gardner. This, he thought, I would find correct on visiting Shoeburyness. Above all, I was to remember that the British Army was using Boxer cartridges, and that guns not adapted to fire those cartridges could not be of any use in the British Service. At Shoeburyness I found the experiments went entirely in favour of the Nordenfelt mitrailleuse; that although the different types competing could be made to fire Boxer cartridges, it was courting accident to use these soft, copper foil and paper cases, in mechanically loaded arms having such a great rapidity of fire. Nor could I understand the utility of retaining the Boxer cartridge in use in our Service, when all foreign nations had already adopted the solid-drawn brass-cased cartridge, and I discussed this question in several articles which at that time appeared in the columns of the press. The authorities reconsidered the question, and announced that the Boxer cartridge should be done away with, and I believe it will be in time.

The Committee reported in favour of the Gardner, and the War Office would supply no other gun, so a certain number of these were issued to the Navy, and were worked side by side with the Nordenfelt four-barrel one-inch gun; the old Gatling—the pioneer of these weapons—having by this time been condemned. But the Nordenfelt action was better liked afloat than the rotary action of the Gardner, the horizontal lever enabling better shooting to be made, and as constant complaints reached the Admiralty of the uncertain working of the Gardner, their Lordships purchased some five-barrel Nordenfelt guns of rifle calibre on trial. In all this the Admiralty have had but one object in view, namely, to supply the Navy with the best arm that it is possible to procure, and I am assured on the highest authority that were the Navy to report to-morrow in favour of any other system or type as superior to those in use, that new

¹ Some statements which appeared in the paper as read have been withdrawn by the author.—ED.

system or type would be forthwith adopted, and not another gun of the old types would again be purchased, for "it is the Navy who will have to use these guns in action," recently remarked the Director of Naval Ordnance, "and it is, therefore, my intention to let the Navy select that weapon it can use to the best advantage." This is, in my opinion, the right policy to adopt with regard to the Navy. I would even go a step further, and dissociate the Admiralty from the War Office, leaving each Department to provide ordnance for its own branch of the Service. In my humble opinion, until we do this, the Navy will never be properly armed, and at the present moment our first line of defence has only the War Office to thank for the endless variety of guns now in use in the Service, causing each ship to carry many different kinds of ammunition, and each ship's company to learn so many different drills, that proficiency is impossible, and accidents often take place. Indeed, but for the wonderful discipline and organization that obtain on board every one of Her Majesty's ships, accidents would be of more frequent occurrence than they are.

In the Army machine-guns are only now being introduced. The military authorities, having but recently recognized the value of these guns for work in the field, have ordered seventy-five Gardner guns wherewith to carry out tactical experiments at Aldershot. Of these, fifty are two-barrelled guns, each weighing as much as the Nordenfelt five-barrelled gun, while twenty-five are five-barrelled guns, each weighing as much as the Nordenfelt ten-barrelled gun. The questions of mobility and efficiency have thus been ignored, and instead of adopting the wise policy of the Admiralty of enabling the Service to decide for itself which system and type is the most useful, the military authorities have strictly adhered to the recommendation of the now old and obsolete Machine-gun Committee Report, evidently forgetting that during the last five years, not only have improvements been made in the systems tried at Shoeburyness, but that an entirely new system—the Maxim—has made its appearance, and claims a trial.

Nor should it be forgotten that while we have been wasting much valuable time in discussing the relative merits of the various types of the different systems of rifle-calibre machine-guns now before the public, the leading military Powers of Europe have condemned them one and all, preferring to arm their infantry with magazine-rifles, and to adopt shell-firing machine-guns for other purposes in the field, and for the flank defence of fortresses. Hence I am of opinion that the tactical experiments about to be carried out at Aldershot will lead to most imperfect results, should but one type of the machine-gun be employed, and that, too, a type that has already proved itself most unreliable in action. Our military authorities are no doubt actuated by a real desire to solve this important question, but to carry out this desire, they should break free from the trammels of the Ordnance Department, and allow the dictates of sound practical common sense to govern their action in this matter. The magazine-rifle should be tried at the same time as the rifle-calibre machine-gun, while the shell-firing machine-guns of two, three, and six pounds should also

find a place in tactical experiments, from which the revolving cannon should not be absent, should it be desired to obtain definite results of all these new arms, and Officers and men set to work them should have the opportunity afforded them of ascertaining for themselves which type of each system they can work to the greatest advantage, and which system above all others they prefer. Personally I advocate neither type nor system, but I deprecate the recommendations contained in the Report of the ancient Machine-gun Committee being acted upon after so many years have elapsed since those recommendations were formulated, years during which the whole science of modern warfare has been made to undergo so many changes.

We have been educating men to believe themselves invincible because of the superiority of their arms, forgetting that when those scientific toys fail them, the men are powerless. Men should be taught to depend on their own individual strength, pluck, and prowess, and not in any single weapon.

It was through the abuse of the use of machine-guns that the French lost many a position during the Franco-German war. The Emperor Napoleon imagined that in the Montigny he possessed an arm so simple, and yet capable of creating such fearful havoc in the ranks of the enemy, that its use would of itself insure victory to his army. Hence, long before the declaration of war against Prussia in July, 1870, the manufacture of the Montigny proceeded briskly in all the French arsenals. The guns, when made, were mounted as field-pieces on trail and limber carriages; the latter were filled with cases of ammunition, and all were carefully stored away and kept under lock and key. Not a soul was allowed to go near them. No drill was compiled for their use. And it was not until the day that war was declared that these guns were issued to the French Army. Then teams of artillery and train-horses, ready harnessed, were sent down with their drivers and improvised detachments, to the stores in which the mitrailleuse had been kept. The horses were hooked on, and thus battery after battery was marched off to the German frontier to join the Army of the Rhine. But, at Spicheren, at Wörth, at Gortz, and Mars-la-Tour, at Gravelotte, at Beaumont, and at Sedan, whenever a French General relied on these guns to enable him to hold a position, he was doomed to be most bitterly disappointed. In numerous cases which came under my own observation whole batteries of the French Montigny guns were captured before they had been able to fire a single round. In other instances, but a few rounds were fired before the gun jammed in such a manner that the untrained detachments were unable to clear them before the Germans were upon them. The last shot had not long been fired on the field of Sedan, when General Sir Henry Havelock-Allan, *B.C.*, rode up to the Balan Gate of that fortified town under escort of a troop of Bavarian dragoons, and obtained admission under the white flag and red cross of the Geneva Convention. I accompanied Sir Henry, and I shall never forget the sight as we threaded our way through the narrow streets of Sedan, crowded with the living, the dying and the dead, to the mairie in which the Emperor of the

French had taken up his quarters. While conversing with various members of General McMahon's staff, and later on in the square of the town where stood the single mitrailleuse battery saved from that day's fight, ample evidence was afforded me of the disastrous consequences that can follow on the abuse of the use of such a weapon in the field.

I spoke to the old battery sergeant-major, a man wearing the English and Turkish Crimean medals. He informed me that not a man of his battery knew how to load or work the guns when they were served out to them. He had first to teach himself, and after each day's march endeavoured to instruct his men, or at least as many of them as were willing to devote some of their spare time to learning the use of the arm they were detailed to fight. "But, sir," he said, "that cannot be done in a day, and no wonder we have been beaten with such a disgraceful organization as ours." This old soldier was very severe in his remarks on the practice of sending untrained men into action to fight with an arm they knew absolutely nothing about.

I subsequently went among the French prisoners, and examined the Montigny guns captured by the Germans. One batch were still close to the position they had held during the battle. From these I learnt as follows:—"We were posted on that ridge over there. The Germans had to come up this steep incline, which our guns were supposed to sweep, and we were to hold the position at all hazards, so as to prevent the flank being turned. When the Germans appeared, we were ordered to reserve our fire until the enemy were within 500 paces. On came the Germans in three lines as steady as a rock. They opened fire, and many of our comrades fell before we got the order to load. This was not easily accomplished. The cartridges, the breech action, everything stuck. At last we were ready, and the order to open fire was given. We believed in our guns, and expected to see them sweep the hillside clear. But after the first salvo the difficulty was to reload. One gun here and there could be heard by its rattle, but the delay was fatal; a few moments more and the Germans were upon us, the guns were captured, and we were prisoners."

If we now turn to the Soudan, we find that the Gardner and Gatling guns worked by our Naval Brigade, men who certainly had the advantage of previous training, did not answer much better. Our guns were also mounted on trail and limber. The limbers, containing the supply of ammunition, were cut off from the guns, and the latter jammed at the critical moment, whereby the lives of the Officers and men who so gallantly fought them were sacrificed. At El Teb, Tamaai, and Abu Klea, and previously at Ulundi, both Gardners and Gatlings failed us at the critical moment of the fight.

I recently asked one of the men present on three of these occasions what he thought of machine-guns. His answer was, "Not much, for when you want them to speak they are dumb." It is in this manner that a most useful weapon gets a bad name, and from the moment that is the case it is very difficult for it to retrieve its reputation.

From the foregoing it is evident that the following conclusions may

be drawn:—(1) That machine-guns, whether of rifle or heavier calibre, should always be worked by trained men; (2) that the men forming the machine-gun detachment should be armed in such a manner as to be able of themselves to defend their gun if anything should go wrong with it, and the enemy come to close quarters; (3) that the gun must never be separated from its ammunition; (4) that in the field the machine-gun should be recognized as having just as distinct a tactical position as cavalry, artillery, or infantry, and that it should never, if possible, be made to do work for which it is not fitted.

It will be readily admitted that the infantry rifle and the field-piece have totally distinct functions to perform on military service; and, although each may in many cases be devoted to the duties of the other, and even fulfil them to a certain extent, the line of demarcation between them is, and from the very nature of the manner in which each is used must be, distinct. Both the rifle and the field-piece are necessary in the military armaments of civilized nations, for neither can replace the other, and the army—all things being equal—that took the field minus the one or the other would assuredly be beaten by an opponent possessing both, as the necessities of service in the field are as great for the one as for the other. But the position of machine-guns in the field has as yet to be determined. Speaking in general terms, the machine-gun of rifle calibre may be regarded as an auxiliary of the infantry, both in the field and in the defence of fixed positions and fortresses. The shell-firing machine-gun, of all calibres, should, however, be looked upon as field artillery; and, whereas the former may be worked by the infantry, by means of men specially trained for the purpose, the latter should be handed over to the artillery, to be organized and worked as a special branch of the corps, until the modern field-piece is done away with, and the quick-firing shell-gun has been adopted in its stead, as will assuredly be the case one of these days, now that the question of recoil has been solved in both the Maxim and the Hotchkiss systems, by utilizing in the Maxim system the power generated by the recoil of the barrel to load and fire the gun, or by taking it up on a non-recoil carriage, as in Lieutenant Verrey's development of the Hotchkiss system. However, the day is far distant when this dream of the artillerist will be realized, and at least one great European war may have to be fought without the aid of such non-recoiling artillery. It would, therefore, be the height of folly on the part of a nation to refuse to arm itself with the quick-firing guns now at its disposal, on the plea that in a few years' time they will be obsolete; for no nation can rely solely on her rifles and muzzle- or breech-loading field-pieces when her neighbours are supplying themselves with machine-guns of rifle calibre, as well as with those constructed to fire explosive shell. All must keep pace with the times. In the present complicated state of affairs in Eastern Europe, there is no telling when the nations interested in the reversionary interest of the Sick Man may not fly at each other's throats, in the belief that one or the other is trying to obtain more than his fair share of the plunder. This has long been understood. The danger has been foreseen. The nations interested

have been forewarned. Hence, we may assume that when the struggle commences, we shall find them all forearmed. Shall England wait? If so, she will assuredly find herself left out in the cold when the division of profits commences. But to continue. The term "machine-gun" is generally misunderstood, and is always accepted in its generic sense. It is made to apply at random to machine or magazine rifles, machine-guns of one or more barrels of rifle calibre, up to 1-inch calibre, and to shell-firing guns. Hence it is obvious that the relative positions of the various systems of machine-guns should be clearly understood before attempting to go a step farther. These may thus be classified—the revolving barrels, the stationary barrels, and the recoil barrel. These systems must be classed as follows:—

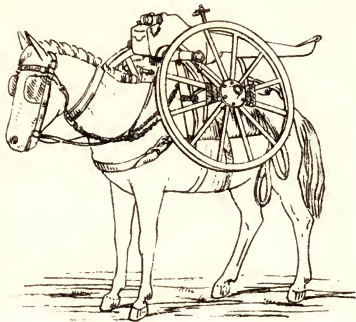
1. The bullet-firing gun, or mitrailleuse, ranging in calibre from 0.35 to 1 inch. This type is more closely allied to the infantry rifle than to the field-piece of the artillery.

2. The shell-firing gun, ranging in calibre from 1.45 to 2 inches and more. This type is more closely allied to the field-piece of the artillery than to the rifle of the infantry.

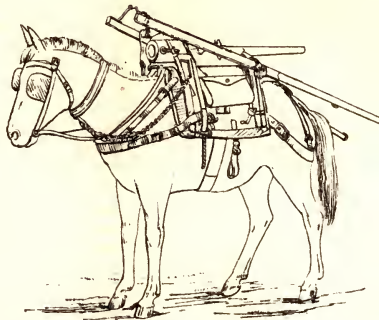
No one would think for a moment of organizing trials to ascertain the relative value of infantry and field artillery fire, with a view of only retaining in use that arm giving the better results of the two! And yet that is what we have been doing with machine-guns. Surely, it stands to reason that, to appropriate any of these guns for work in the field for which they are specially adapted, is to make a right and proper use of a valuable invention; while to set guns of rifle calibre to perform work that shells alone can successfully accomplish, is an abuse of an arm that might lead to ultimate disaster. But, by far the greatest abuse of the use of machine-guns it is possible to make is to set men to work them who have had no training in their manipulation. The men set to work machine-guns should be as intimately acquainted with the working of every part of the mechanism of these guns as a surgeon is with the anatomy of the human body. And just as the latter can tell by his patient's pulse what is wrong with his anatomical system, so should the man working a machine-gun be able to tell instantaneously, by the feel of the throb or jerk of the firing lever in his hand, what has gone wrong with the internal mechanism of his piece, and at once be in a position to clear the action without the use of force, thus avoiding accidents, while at once bringing his gun back into action.

Five years ago I joined the Volunteers. At that time machine-guns had only been used in this country by the Navy. But it was evident that the great improvements introduced in the mitrailleuse would at no distant date cause it to be an important factor in all military operations. Lieutenant-Colonel Alt, commanding the Central London Rangers, came to the conclusion that this arm was particularly adapted to that very species of work that our Volunteers may be called upon to perform, such as repelling landing parties on a coast, defending fixed positions, mountain passes, roads, and bridges, and it was determined to obtain the sanction of the authorities for two rifle-calibre machine-guns to be added to the establishment of the

QUICK FIRING MA

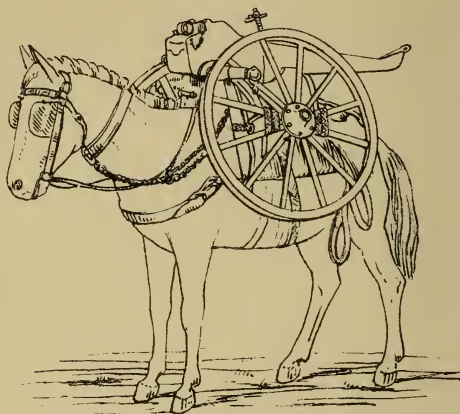


CARRIAGE ON MULE.

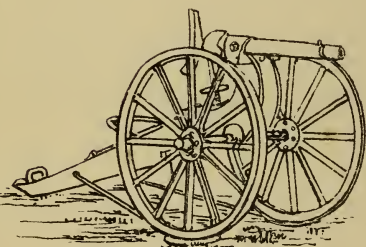


GUN ON MULE.

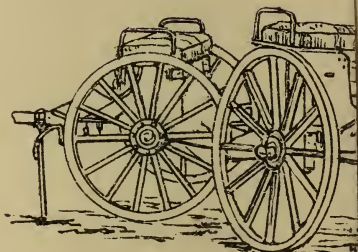




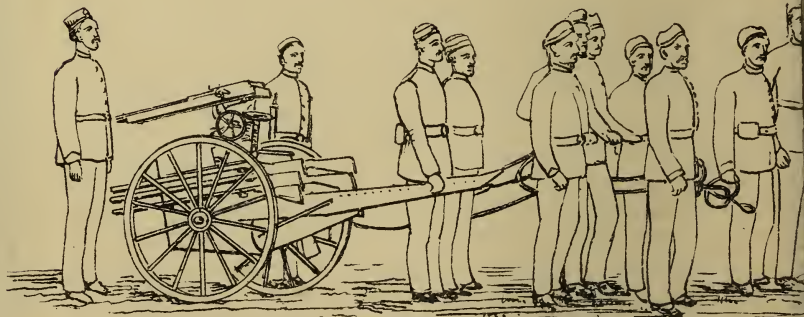
CARRIAGE ON MULE.



HOTCHKISS 1-PDR. QUICK-FIRING
SHELL-GUN WITH SHOULDER-PIECE.



HOTCHKISS REVOLVING CANNON MOUNTED
ON FIELD GUN.



A GUN OF THE CENTRAL LONDON RANGERS ON THE MARCH, DRAWN BY A DETACHMENT OF 10 MEN, OF
WHICH 4 ARE ON THE TRAIL, 4 ON THE DRAG ROPES, AND THE 2 NON-COMMISSIONED OFFICERS IN REAR.

NORD

regiment. The first thing we did was to procure the guns. The next to ask leave to be allowed to use them. Had we reversed the order of things, the probabilities are that we should never have obtained the guns, but as matters stood, having them we demonstrated the possibility of using them in conjunction with infantry. The Central London Rangers (22nd Middlesex R.V.) was the first infantry battalion to use the machine-gun in any form. At first our guns were mounted like field-pieces, with trail and limber; but we soon found that in close infantry formations this way of mounting rifle-calibre machine-guns rendered them useless. For whenever the guns had to be brought into action, they first had to be reversed, and the limber taken to the rear, the ground covered by the operation rendering it impossible to work them in close formations. Then, again, when required to advance it was necessary to limber up. In this manner delay arose, while should square have to be formed, and the guns brought into the angles, reversing them to get them into position scattered the wheeling half-companies or sections in all directions.

Colonel Alt was thus enabled to arrive at the conclusion that rifle-calibre machine-guns would have to be worked from a limber or magazine carriage; and having explained to me his views, I, in conjunction with Mr. Nordenfelt, from whom we had obtained our guns, designed in 1884, for Colonel Alt, the carriages we now have in use. The Alt machine gun-carriage is a combination of limber and trail on two wheels. The limber forms a magazine, protected in front by means of a Cammell compound armour plate, about half an inch in thickness, through which no rifle bullet can penetrate. The limber or magazine carries 5,000 rounds of ball cartridge, and on either side are racks for the rifles of the gun detachment. The trail is supported by four men when on the march, the drag-ropes being hooked on to the axles, as in the naval field-piece. The gun is mounted on the limber between the wheels, and can be trained through an arc of 180° without moving the trail. Gun, carriage, and ammunition only weigh 10 cwt.

Having obtained the guns, the next thing to do was to train men to work them, and Colonel Alt having placed the guns under my command I proceeded to compile a drill from our old naval field-piece drill. Volunteers were not wanting from the rank and file of the Rangers to man our machine-guns, and in three months we had over 100 men trained to their use. Taking a detachment composed of men who had made themselves efficient in the ordinary sense of the term, but who had never seen a machine-gun before, men who, nevertheless, were steady drills in the ranks, good shots, and intelligent soldiers, I found that, although they could handle their rifles, they were utterly useless when set to work a machine-gun without previous training. In fact, the machine-gun in their hands became a source of danger to themselves and their comrades, more so indeed to the latter than to the enemy. For example, to work a machine-gun properly it is necessary that the various duties should be allotted amongst the gun numbers in the same manner as with all other ordnance, whether large

or small, and the duties of No. 1 who aims and fires are not more important in this case than those of the higher numbers, who have simply to fill the hoppers. To the uninitiated this may appear somewhat strange; but it is here that it will be found necessary to have men well trained to their work. It may seem an easy thing to fill a hopper, and yet an expert hand cannot do the work under thirty seconds, and could not keep up this rate of filling. In action if he filled continuously two hoppers in one minute and a half, it is all he could do. But a hopper for the five-barrel gun only contains fifty cartridges. The gun will fire ten times that number per minute at close quarters, where rapidity of fire is essential. Hence ten full hoppers have to be passed up to No. 2 every minute. Consequently, at least five men are required, supposing they each fill two hoppers per minute, which no man can do for long. The Alt carriage holds 5,000 cartridges, which at the above rate would be expended in ten minutes. I do not believe that any machine-gun will ever be called upon to keep up such a rapid continuous fire for so long a period as ten minutes, as it seems to me that if the fire be well directed the enemy must be repulsed or annihilated before he can reach guns pumping lead at such a rate. The final rush is never begun at a greater distance than 500 yards from the point attacked. The skirmishing up to this range would afford but few opportunities for lengthened periods of machine-gun fire. The final charge will be arrested in the first two minutes; if not, the chances are that the enemy will charge home, as they did on the plains of France in 1870 and later on in the Soudan.

It will be seen that the Alt carriage carries six rifles. The numbers to whom these rifles belong carry them slung from the moment the gun gets into action, when, if attacked by cavalry, they at once form up, three on each side of the gun, to protect Nos. 1 and 2, and the higher numbers employed filling hoppers in the rear. I maintain that machine-guns, in whatever way they may be employed, should always be worked by men specially trained, and for this purpose it is necessary to create a machine-gun corps, with a dépôt at which to drill the men. I would form this corps of detachments of all arms, and as soon as the Officers and men have become proficient they should be sent back to their own corps or regiments. I would, however, retain at the dépôt a sufficient number of men to man at least 200 machine-guns.

Allowing 20 men to each gun, this would need only 4,000 men, and 250 Officers, allowing a subaltern for each gun and a Captain to every battery of four guns.

I have tried to work these guns with 8, 10, 14, and 17 men, but find that 20 should be allowed to each. Seldom will it be possible with this number of men per detachment to turn out on parade more than 17 men per gun. Of these, six should be armed with swords and revolvers, the remainder should carry rifles or carbines, sword-bayonets and revolvers. Each man should have a hopper in a leather case strapped to his back, each hopper containing fifty rounds of ball cartridge. This would enable the gun to fire for two minutes

before the men filling hoppers would be called upon; it would also give the men time to settle down to their work.

I find it is necessary to examine every part of the breech mechanism before bringing the gun into action after a march, even when made over good roads, but when the gun has been taken over rough ground this is absolutely necessary. This duty is performed by Nos. 1 and 2, while Nos. 3, 4, 5, and 6 open the limber and carry the first drawer-full of ammunition three paces to the rear, deposit it on the ground, and stand by to pass up the filled hoppers, while 7, 8, 9, and 10, and the higher numbers go on filling. When threatened by cavalry or otherwise, the six highest numbers grasp their rifles, fix bayonets, and fall in on each side of the gun, coming down to the "prepare for cavalry," and using their rifles as opportunity offers. By this organization the feed of the gun is uninterrupted, while its defence is assured. The gun can also be advanced with its muzzle to the enemy, the higher numbers manning the drag-ropes, 7, 8, 9, and 10 supporting the trail, while 3, 4, 5, and 6 carry the magazine and spare gear.

By means of constant drill my men have succeeded in getting so well accustomed to their work that when on the march they can from the command "Battery—Halt!" "Action—Front!" (right, left, or rear), go through every motion correctly, fix distributor and filled hopper and fire 50 rounds (10 volleys of 5 rounds each) in 18 seconds. They have done this work over and over again in this time. I have taken them unawares when on the march at Aldershot and in the Portsmouth country, but they were always ready and equal to the occasion, seldom requiring over twenty seconds to fire the rounds. But when untrained they took three to five minutes to do the work. Now what does this mean? Would an untrained private of the Regular Army be able to work the gun more smartly? If it took three months to train 100 Volunteers in such manner as to render them self-reliant, and able to work the gun in the field, even though every Officer and non-commissioned officer fell out, would it take a shorter time to train Officers and men of the Regular Army? I think not, for the work is as new to the one as to the other, and the regular soldier cannot be credited with a greater intelligence than the Volunteer. The former excels at drill because he is always at drill; my men excel in working a machine-gun because no other body of men have been trained to the work. It will take as long a time to drill 100 Regulars as it took to train the 100 Volunteers, unless the former were made to drill longer hours; even then it would take at least a month to accustom the men to the guns. But in a month a war may be nearly over. The men could not be sent into the field while untrained, and to place machine-guns on baggage wagons or artillery limbers, or to send them with cavalry before the men are trained to their use, is simply to court defeat and disaster. The guns under such circumstances become a source of weakness, instead of one of strength, an incumbrance instead of an efficient means of defence.

Consequently, before machine-guns can be used with success and

intelligence, first must the men be trained, and the smarter these men are the more efficient will the guns be found, the more destructive will be their fire, and the less likelihood of their being put out of action through jams and other mishaps arising at critical moments.

That the tactical value of this arm is great, when properly served, no one will deny. Of its strategical importance I will say little. Machine-gun tactics do not exist, and the proper position of this arm has not yet been determined. At Portsmouth and at Aldershot I was not allowed to move my guns without an escort. In vain I assured the General and the Umpires that my guns were self-supporting; each gun having its own small-arm men. It was of no use, escort I must have and escort I must wait for, or submit to be ruled out of action. And when I got my escort—a volunteer company of men not half so well trained to support fatigue as my lads who had been knocking the guns about for two years—of what use was that escort? Could it keep up with the guns? No. Guns in my opinion should, when in action, creep or sneak, or move at the double to seize positions. There must be no indecision or loitering; hence we nearly always move at the double, and our escort after a 500 yards spin would gradually assume the form of a comet, the commander and his subs forming the nucleus. On one occasion a Staff Officer rode up to one of these escort subalterns who happened to be well in the rear on the Eelmore Bridge road, and asked what he was doing there. “What are you, sir?” queried the S.O., who was somewhat astonished on receiving the reply, “Leading guide of that company, Sir, disappearing over the brow of yonder hill.” A look at the plight of the Officer struggling up the hill was enough for the S.O., who rode off to tell the tale to many a comrade. But the guns had gone up that hill at the double, and were already in position or in action before the escort appeared. Hence I believe these guns will be found of immense service in seizing positions some distance in advance, and in holding the same until the main body comes up. It is all a question of training the men.

They will also be found of use in defeuding roads and bridges, ditches, and breaches in fortifications, earthworks in the field, mountain passes, and river fords; but I do not believe in their use in the fighting-line of an attacking force. They offer too great a target. I would sooner use them from a sheltered position to support the fighting-line. I believe they will be of great use in flanking or turning movements, especially if they can be brought up on the flank of the enemy's artillery, when in a few minutes there should be neither gunners, drivers, nor horses to work the guns. I am, of course, alluding to rifle-calibre machine-guns, having an extreme range of 3,000 yards. These, as also shell-firing guns of small calibre, should, when used for outflanking purposes, be mounted on carriages similar to the one invented by Lord Charles Beresford, and termed, very appropriately, galloping carriages, as, from the wider *détour* it is always necessary to make, horses alone could cover the distance in a reasonable time.

Shell-firing machine-guns are artillery, and should be used as such.

I cannot conceive anything more demoralizing than for a brigade to be opposed to the fire of even a single battery of shell-firing machine-guns. It is bad enough already when the shell fall from each gun at the rate of two, or at most three, per minute. Imagine what it must be when each gun will be able to send fifteen to twenty shells per minute on their demoralizing and destructive errands. One shell is far more demoralizing than a volley of rifle bullets. When the latter are *heard* the soldier knows that all danger is passed; but when the shell is heard he knows not only that the projectile is coming but also that the explosion is near at hand. Of this I had ample evidence in the Franco-German War.

I do not consider myself justified, for many reasons, in discussing the relative merits or demerits of the various types of machine-guns now before the public, my position as Editor of a Service Journal demanding the strictest impartiality in such matters. My sole object in delivering this lecture is to call prominent attention to the fact, that no matter what type is adopted for Her Majesty's Service, that type will undoubtedly disappoint all expectations, unless the men told off to work the guns are, in the first instance, thoroughly trained to their use. Hence I sincerely hope and trust that before machine-guns are again used in the field a machine-gun corps will be formed, and the Officers and men thoroughly trained, so as to minimize, so far as human foresight can, the chances of the recurrence of such disastrous consequences as attended the abuse of the use of machine-guns by the French in 1870, and by our own troops in the Soudan.

Machine-guns have been divided into three distinct systems. Between the mitrailleuse and the rifle there is an intermediary arm—the magazine-rifle. This is exclusively an infantry firearm, requiring, however, special fire tactics for its use, as it possesses a greater fire-power than the ordinary line rifle, their relative rates of expenditure of ammunition being as about 1 to 2. When the Bethel-Burton magazine-rifle was recently under trial at Enfield, an expert was set to fire it; so rapidly did he manipulate the lever that he did not give time for the hang-fire cartridges to ignite and explode in the chamber. They were extracted so quickly that they actually exploded in the firer's face, and, I believe, the rifle was condemned on that account. Here, then, we have an instance of a useful arm condemned owing to its unintelligent use—to its abuse, in fact—as neither the rifle nor the machine-gun is responsible for the defects to be met with in the ammunition. The same thing has happened to the Gatling gun with its new “positive feed.” Some North American Indian chiefs were invited to see this gun fired. With such rapidity was it worked, that the hang-fire cartridges were extracted and thrown on the ground before they ignited, and they then exploded among the legs of the bystanders. The Indian chiefs took to their heels and bolted, and no persuasion could induce them to return to that gun. At Aldershot, when firing Nordenfelt guns, several cartridges hung fire, and the explosions thus caused in the distributor and hopper so burnt the men of the Central London Rangers working

the firing lever, that they were driven from their guns. A momentary panic ensued, during which an enemy might have captured those guns with ease. The same has happened with every other type of rifle-calibre machine-guns except the Maxim. The other types are also liable to be choked by the extractor tearing off the base of the cartridge-case, thus leaving the metal case itself in the chamber. The bullet of the next cartridge presented to that chamber gets wedged. The cartridge itself gets crushed and cut by the force exerted to drive it home by the improperly-trained man working the lever. The gun is at once jambed, and whilst unable to fire from this cause, the enemy are upon it, cut down its detachment, and capture the gun and its position. This is solely caused by the unintelligent use of the arm, or by the ammunition supplied being of faulty manufacture.

The mitrailleuse represents a concentrated infantry fire, delivered from a relatively small space, so long as the gun is clear and in working order; also a concentrated case-shot fire, within infantry range, and that from a very mobile piece of artillery. The concentration of mitrailleuse fire, as compared with the line rifle, is established as being 100 to 1; from which it follows that, with the magazine-rifle, it stands as 50 to 1. Compared with the field-gun its effective range of case-shot fire is as 5 to 1, 300 yards being considered the limit of case-shot fire, and 1,500 yards that of mitrailleuse fire. The concentration with case-shot range is as $2\frac{1}{2}$ to 1, assuming a mean of the number of bullets in a case-shot of the 9-pr., and the 13-pr., with a speed of fire of two shots per minute.

The revolving cannon represents a highly concentrated and complete but light artillery fire. Within artillery case-shot range, its concentration of case-shot fire is to mitrailleuse fire 2 to 1 (speed of fire being eighty shots per minute with twenty-five effective pieces to each shot), and to artillery fire as 5 to 1. Its range of case-shot fire is to that of the mitrailleuse as 1 to 5, and is equal to that of artillery fire. Its concentration of shell and shrapnel fire is to that of artillery as 25 to 1. (The carriage being non-recoiling, and the gun being provided with traversing gear, speed of aimed fire for continued effective fire is reduced from the maximum of eighty shots per minute to fifty per minute.) In destructive power against obstacles, it is to field artillery as about 1 to 5. This is assuming for combined penetrating effect of shell and weight of effective pieces of shell and shrapnel 1 to 4 as compared with the 9-pr., and as 1 to 6 as compared with the 13-pr.

The quick-firing shell-gun presents a complete and concentrated artillery fire. Within artillery case-shot range, its concentration of case-shot fire is to mitrailleuse fire as 1 to $1\frac{1}{2}$, and to artillery fire as 2 to 1. Its concentration of shot and shrapnel fire is to that of the revolving cannon as 1 to 4, and to that of field artillery as 6 to 1. In destructive power against obstacles it is to revolving cannon as 3 to 1, and to field artillery as 1 to 2.

In mobility, the magazine-rifle is equal to the line rifle. The single-barrel mitrailleuse is inferior to the rifle, and superior to the field-gun. The multi-barrel mitrailleuse, the revolving cannon, and

quick-firing gun are equal. In field service it is considered that for the transport of gun and ammunition the same total weight will be found for the three, and this weight is so subdivided, as to require practically the same means of transport. The abstract military powers of these guns are closely represented in the following table, which although subject to even considerable modification, under special circumstances, gives a true basis for ascertaining the comparative military value under the different fundamental applications :—

| | Concentration of infantry fire. | Concentration of case-shot fire. | Case-shot range. | Concentration of shell and shrapnel fire. | Shell and shrapnel power. |
|------------------------|---------------------------------|----------------------------------|------------------|---|---------------------------|
| Normal rifle | 1 | 0 | 0 | 0 | 0 |
| Magazine rifle | 2 | 0 | 0 | 0 | 0 |
| Mitrailleuse | 100 | 2½ | 5 | 0 | 0 |
| Revolving cannon . . | 0 | 5 | 1 | 25 | 1 |
| Quick-firing gun .. | 0 | 2 | 1 | 6 | 3 |
| Light field piece... | 0 | 1 | 1 | 1 | 5 |

It is most important to bear in mind that whilst it is easy to prove the above comparative analyses of the relative superiorities of these new arms, and to attribute in special cases even higher values in one or more of the factors, it does not necessarily follow either that all of these systems should be introduced into the equipment of every army, or that the adoption of one does away with the necessity of adopting another. The operation of large entirely equipped armies gives rise to certain very prominent circumstances of service; those of well equipped and handled armies against forces only large in number bring other considerations into prominence. What is termed guerilla warfare brings an entirely different set of cases under our notice, while the operations of troops in suppressing riots and local uprisings afford us examples of situations differing from all cases above referred to. As a general illustration, let the armaments of nations be arranged to meet the above special requirements. Austria, with no Colonies, and a minimum of chances to send armies against other than thoroughly equipped foes, is bound mainly by the first conditions. England and France are constantly brought into contact with half-civilized hordes surrounding their Colonies, and have the corresponding circumstances brought into prominence. The United States, constantly campaigning against savages on the war-path, must specially provide for guerilla warfare. In the same country the totally distinct National Guard has for its prime necessity of existence the maintenance of local order and the suppression of riots. The possibility exists that an Austrian Army may conduct a guerilla warfare, or the United States Army may be opposed to a thoroughly equipped European force. It may be wise to provide for the even-

tuality, but it would be neither wise nor economical to provide for it at the sacrifice of more probable contingencies, or to a greater extent than the probability demands.

The systems into which I have divided machine-guns are generic, each having its well-defined limits of service under all conditions. It may be stated as a military axiom that a generic system having been determined upon, but one type or system should be introduced. As an example, there exist several well-established types of mitrailleuses, all belonging to precisely the same generic system, having the same mobility, power, and speed of fire, and only differing in mechanical principles. If sufficient reason exists for the introduction of one of these types, then, since in military value they are alike, the mechanical principles of this one must be considered, either actually superior to the others, or capable of more complete development. That is to say, that shell-firing guns of the same type and of any calibre, as well as the mitrailleuse, can be produced, thus dispensing with an endless variety of systems and drills to obtain the same result. It follows then that other systems or types should not be introduced, either simultaneously or at such short intervals as shall keep the generic system in a constant state of change. Substitution may take place, intermingling never, and no substitution should be made until a new system or type has been developed, entirely and indisputably superior to the old one in all qualities.

In the English military and naval light artillery equipments are found the maxima of types of the same systems.

The official reason for this intermingling is that such a practice prevents the growth of monopolies, and incites competition for the perfection of arms. Such a reason has no foundation whatever.

Were England alone concerned in the matter of armament, monopoly might give rise to a neglect of perfection, but the whole world is continually demanding improved arms, so that a constant and close competition must be maintained. Again, monopoly, so far as it concerns the supply of a certain type of arms to the Government, has none of the attendant dangers met with under the ordinary commercial signification, especially in a country fully supplied with Government workshops for the manufacture of arms.

If the reason be sound in principle it must be general in application, and consequently applied to heavy guns. But the absurdity is at once visible of England having in her Service at the same time heavy guns of the Armstrong and Whitworth types, and of the Krupp and French systems.

Major-General Bylandt Rheidt gives in his "Handbook of Field Artillery" a concise and comprehensive definition of the main utility of the mitrailleuse. It is as follows:—

"The mitrailleuse represents a concentrated infantry fire from a relatively limited space, or a concentrated case-shot fire from a gun having great mobility. It is effective in the defensive and in surprises when its march can be covered; it may render excellent service in the offensive, but it is not possible to utilize it in such cases except in an entirely exceptional manner. Mitrailleuse batteries should be

employed principally in the defence of localities, entrenchments, defiles, thickets, and villages against an enemy seeking to capture these positions by assault. They may be used to either sustain or replace either infantry or artillery in positions where either a powerful case-shot fire is needed, or where an intense salvo fire is required from a limited space. They should never be used except against troops, particularly when in masses, columns, squares, or closed lines. They should never be used against artillery, except they may approach it by surprise, or take it in flank, at a range not exceeding 1,500 paces."

From this definition several important points are clearly brought out, that must be carefully borne in mind in any discussion. The mitrailleuse is neither a pure infantry arm nor a pure artillery arm. It is not an offensive weapon; this is an especially important point, for, as the General remarks, it may render excellent service in the offensive, but such circumstances are exceptional. Being so they have but a secondary importance in considering the absolute military value of the weapon. It must be used against massed troops. Now it is not meant that it cannot be used against deployed troops, but that such use gives to it a minimum of efficiency.

In considering the applicability of any generic system to infantry, cavalry, and artillery service it is necessary to keep constantly in view the distinction between the two branches into which the subject naturally divides itself. These are, 1st, the discussion of the utility of the system as an arm of the corps under consideration; 2nd, its utility as an arm with that corps. As an example, the magazine-rifle is an infantry arm, as pure as the normal rifle. Being purely an arm of that corps, any discussion of its utility as an arm *with* infantry (such as the consideration of arming certain battalions only with the magazine) becomes a matter of secondary importance in establishing its absolute value. It may be discussed with equal importance both as an arm *of* and *with* cavalry; that is, as in the hands of cavalry or bodies accompanying it. It may be discussed as an arm *with* artillery, but not *of* it, for in so far as general utility is concerned the personal arms of the artilleryman are completely effaced in the presence of a discussion of the main field of service of that branch. The sabre and the lance of the cavalry never completely efface the revolver, the carbine, and the rifle. Indeed, in those two bodies, now so universally recognized—dismounted cavalry and mounted infantry—the rifle and carbine completely efface the sabre and the lance.

It is often stated of the mitrailleuse, especially of the single-barrelled one, that it is a small-arm and not a gun. This is not a statement upon which a valid discussion can be based, for it is only half true and is wholly misleading. It is neither a small-arm nor a gun, but it possesses properties belonging to both, and these properties which give it a superiority as compared with one, form embarrassments in comparison with the other. The magazine-rifle is the maximum development of the pure small-arm, the revolving cannon is the minimum development of the gun, the mitrailleuse stands between the two. Batteries of mitrailleuses may have the organization of

artillery, but they cannot be discussed as artillery, since they cannot fulfil its main requirements. Mitrailleuses have infantry fire, but they can neither be given infantry organization, nor can they fulfil the main requirements of infantry service.

If a body of infantry be armed with magazine-rifles, its power of concentrating fire will be doubled under all circumstances, for the mobility of the body itself is undisturbed, thus permitting of the same freedom of deployment or concentration, whilst under both conditions the rapidity of aimed fire is doubled. The question of the utility of making a substitution of the magazine for the normal rifle brings into serious prominence the question of ammunition supply. This question is, however, of itself too radically considered. However vital the necessity of long maintained concentration of fire, the circumstances of action do not make of it the main feature of consumption of ammunition, much more depends upon individual intelligence in the use than in actual rapidity, so that a thoroughly trained body of infantry may develop the full superiority of the magazine-rifle with no greater expenditure of ammunition than average troops with the normal rifle.

With the mitrailleuse the circumstances are quite different. Its highly concentrated fire from a limited space gives it a maximum effectiveness against masses of troops, and a minimum against deployed bodies. It has been stated that the concentration of the mitrailleuse (multi-barrelled) is fifty times that of the magazine-rifle. It is readily seen, however, that against a skirmishing line, for example, fifty men deployed with magazine-rifles, or even normal rifles, are far superior to one or even several mitrailleuses. In order, then, that the superiority of the mitrailleuse should be established, its full concentration of fire must be allowed for under all circumstances of use. That it *may* be used for single-shot firing is no real recommendation, since its utility in such cases is not comparable to the ordinary rifle. With the magazine, however, its use as a single-shot arm holds it under all normal circumstances equal to the other rifle, whilst giving it the full benefit of its concentration.

As an arm to be used with artillery, one of the main claims of the mitrailleuse for superiority is its adaptability to the defence of the artillery itself, and in this respect two different adaptations are presented: 1st, the multi-barrelled gun, which, with its equipment, forms an artillery unit; 2nd, the single-barrelled gun, which, mounted on the gun-limber, forms only a part of an artillery unit. In the first instance the utility of the gun is at a minimum, since on the march it must occupy a specified place in the artillery column; and in the event of sudden attack the time necessary to unlimber and bring this mitrailleuse into action is practically equal to that of the artillery itself; whilst in action, since its rôle is entirely distinct from that of the artillery, if held in line its utility is at a minimum. Again, the total force of the mitrailleuse so employed is deficient in strength if detached at any given moment from a battery to act independently. Finally, since mobility of artillery is of the most vital importance, the number of guns per battery must be reduced so as to allow of the

substitution of the mitrailleuse, or the battery unit must be increased, and so make it unwieldy. In regard to guns mounted on the limber, their utility is at a maximum. In this case, however, there are certain drawbacks which need most careful consideration. For example, it has been urged that 1,000 rounds of ammunition is a sufficient supply for a gun thus mounted, but even were only 500 rounds per gun carried, the extra weight thus added to the limber, by gun and ammunition, would be 80 lbs., while the space required for ammunition alone would be 1,000 cubic inches. Hence it is obvious that a sacrifice must be made somewhere, either by overloading an already crowded limber or by reducing the artillery ammunition proper by fully one-fifth, for it must not be forgotten that the chief aim of the artillerist is, and always has been, to lighten and disencumber the limber to the greatest extent possible; and this has already been carried to such an extent that the supply of ammunition at present carried in a gun-limber is altogether inadequate to the demand made upon the gun in the field, while no artillery rule is stricter than that, except in very rare cases, guns must be closely followed by their ammunition wagons, in order to ensure even a fair supply in action.

Consequently, the question can here be asked whether the benefits to be derived from mounting a mitrailleuse on the gun-limber would compensate for the encumbrance thereby created. So far the answer has been that the addition of the mitrailleuse will render field artillery more mobile, by doing away with the necessity for an escort. But this assumption is only well founded when the mitrailleuse is worked by a detachment of trained men, sufficiently numerous to supply the escort. Otherwise, in case of attack, the mitrailleuse would be as powerless as it was in the Soudan. Another drawback to guns so mounted is that the horses and *personnel* of the artillery battery are in the way, and would prevent its being used to advantage, especially when the attack is made in front or rear.

Against a deployed attack from any direction the service that the gun so mounted could render would be at a minimum, as the ammunition it carries would be expended long before the enemy came to close quarters. Even supposing that the mitrailleuse could repulse an attack when so used, it could neither prevent the disabling of the battery horses, and consequent delay in moving the guns, nor could it supply the draught power necessary to replace that loss. Whatever the shortcomings of artillery escorts may be they perform certain necessary duties which the mitrailleuse cannot, namely: 1st, they may keep off the attack by their deployment, and thus give timely warning to the battery, and enable it to shift its position; 2nd, the escort can offer the full power of resistance in whatever direction the attack is made; 3rd, the escort can supply the lost draught power at any critical moment, and prevent the guns being captured by bringing them out of action. For these reasons I am of opinion that unless the mitrailleuse is manned by a detachment sufficiently numerous to supply draught power and escort, the latter cannot be dispensed with, and that the mitrailleuse, mounted on an artillery

limber or baggage wagon with but two or three men detailed to work it, would prove not only an encumbrance but a source of weakness, and not one of strength.

It has been urged for the mitrailleuse that it might be used for finding the range. But since the service of artillery as a firearm commences where that of the rifle ends, it seems scarcely worth while to consider this point.

The mitrailleuse can find its own range up to 1,500 yards, but it is a matter of difficulty to quickly establish the longer ranges, as even with the shells of the artillery it is a difficult task, one the rifle-bullet of the mitrailleuse is totally incompetent to perform.

From the foregoing I draw the conclusion that, whereas the rifle-calibre machine-gun or mitrailleuse should be used as before stated, solely by or in conjunction with infantry, machine-guns of larger calibre, throwing explosive shell at the rate of from fifteen to, say, thirty projectiles per minute, should belong entirely to the artillery. Furthermore, that the infantry machine-gun must fire the infantry ammunition, must at all times have a spare ammunition wagon close handy, and must never depend upon untrained men for its manipulation in the field. Finally, since the mitrailleuse is neither a pure infantry nor artillery arm, but is under many circumstances of the highest value as an auxiliary to either, it should be given the maximum freedom of action in order to fully furnish this auxiliary service. It should have a complete organization, and this organization should be to the highest degree self-reliant. On the field it should not be hampered with unwieldy escorts, but should be permitted to accept great risks, in order to derive its highest benefits. It must not be forgotten that whilst it is possible for a mitrailleuse to be as effective as a battery of artillery or a battalion of infantry, its loss on the field of battle would never be so serious as that of either of these two.

In conclusion, allow me to express my thanks to the inventors of machine-guns who have responded to an invitation I sent them to forward me the latest data that they possibly could connected with this arm. From that data I have been enabled to compile this paper, and give you most of the figures and facts which I have brought forward to-night. Our Secretary, Captain Burgess, has been kind enough to place in my hands a pamphlet written by Lieutenant Benson, R.A., "On a Machine-gun Battery and its Equipment." That pamphlet was written before my lecture, but only came into my hands since my own paper was printed. In it Lieutenant Benson advocates exactly what I have advocated for these guns—perfect freedom of action in the field, so as to utilize to the utmost their great mobility, especially when properly mounted. I will not say anything more about Lieutenant Benson's paper, because it will be detracting from its value when it appears in the Journal.

Admiral BOYS: My lord and gentlemen, I shall detain you but a very few minutes, and will leave it to those more recently connected with these guns to enter into the main discussion of the subject. The fact of the matter is this, I happened at the time mentioned, to hold the position of Director of Naval Ordnance. My assistant, Captain Hall, was sent to Sweden to witness some torpedo experiments there, and came across what I believe was the original Nordenfelt gun. He was so much struck with it, and our Gatling guns had been so frequently failing, that he made a very good report of it to me. I reported on it to the Admiralty, and we had some communication with the Director of Artillery on the subject. He at first did make

objections, not I think to the gun itself, but at that time the War Office had to provide in their estimates the money for all our naval ordnance materials, and he had not any money to assist us with. I do not recollect myself that he made any objection to any individual gun. However, it did happen that the late Mr. Ward Hunt, First Lord of the Admiralty, pressed on the Secretary of State for War that the Navy really wanted this gun, that it was a great improvement on the Gatling, and instead of having a Committee which was proposed, and which we objected to at the time on the score that a Committee might cause delay, and it was really urgent for the Admiralty to have some of these guns (I think Mr. Nordenfelt will bear me out), the contract was drawn up in my office at the Admiralty and concurred in by the War Office. We ordered the guns, and the War Office approved them and paid for them. I see the first point of detail is the Boxer cartridge. The Boxer is a soft cartridge, and is not adapted to rapid-firing machine-guns. The consequence was the Committee reported this, and a solid-drawn cartridge was approved for machine-guns. It was considered to be a *sine quâ non* that the machine-gun cartridges should be identical with those for the rifles. When the solid-drawn cartridge recommended by the Machine-gun Committee was adopted, they had in view the object that the Martini-Henry rifles should ultimately be altered to take this cartridge. However, that fell through for various reasons, and I am glad to hear that a solid-drawn cartridge of a new description is to be introduced for our new rifles. Captain Armit says after this he went to Shoeburyness, and found "the experiments went entirely in favour of the Nordenfelt mitrailleuse." Of course that was Captain Armit's opinion, but it was not the opinion of the Committee then, nor do I believe that it is now. I can assure you that in my experience of five years as D.N.O. at the Admiralty, we always obtained as far as possible from the War Office what was reasonable and necessary for the Navy. I am happy to say the Navy now have many of these ordnance equipments in their own hands, and they are not dependent altogether upon the money taken in the War Office estimates. There is one other point of detail I should like to touch upon, that is the question of weights—I am alluding only to small machine-guns. The weight is hardly an element in the system of rifled machine-guns, because any one will see here in the guns before us, that the barrels are the same; the system is only different in the action at the breech, and the difference in weight of the action of one system and another can only be a matter of a few ounces. The weight is in the frame and mounting of the weapon, which has comparatively nothing to do with the system. A great deal more has been made about the comparison of weight between these small machine-guns than there is any occasion for. You may increase or reduce the weight as you please consistent with strength in the framework and the mounting, but I must tell you the heavier the mounting in comparison with the barrel, the steadier and better is the shooting of the gun. I know that great improvements have been made in the Nordenfelt rifle machine-gun, and all the defects (not very important) that were exhibited before that Committee have now I believe been thoroughly removed, and the only difference in efficiency between the two guns, the Gardner and the Nordenfelt, is that one has the reciprocating or pump-handle motion, and the other the rotary or winch-handle motion. Some people seem to think one is more detrimental to good firing than the other. My own opinion is the rotary motion is the more steady and the better of the two, and not so likely to pull the gun over; but I would not condemn either gun for the reason of the manner of its being fired in one way or the other. I will not detain you any longer. I have no doubt there are many here who will make some remarks on the state of the machine-gun question in the present day, but as I regret to see in the remainder of the paper there is little or no reference made to the use or abuse of machine-guns on board ship, I have nothing more to say in discussing this paper.¹

Mr. C. FREDERICK LOWE: My lord and gentlemen, there is one matter of detail as to machine-guns which has not been touched upon by Captain Armit, or in the

¹ Captain Armit having withdrawn certain statements respecting the action of the Machine-Gun Committee, Admiral Boys has withdrawn his objection to those statements.—ED.

lecture recently given by Major West, of the Royal Horse Artillery. I was very much struck in reading General Gordon's diary at Khartoum to see a suggestion made by him that machine-guns should be fitted with telescopic sights. That suggestion appears to be extremely practical. Colonel Walker, who was on the Staff at Hythe and Fleetwood, in a book about rifle shooting, published in 1865 (p. 180), says that "a telescope about six inches long with cross wires may be fixed to a rifle without any other sights and with excellent results. The Confederates had some hundreds of Whitworth rifles with adjustable telescopes, and were thus enabled to distinguish and kill Officers at 1,500 yards." Therefore more than a quarter of a century ago muzzle-loading rifles fitted with telescope sights were tested on active service. I also remember reading a statement that during the siege of Charleston one skilled marksman furnished with the best possible rifle of the day, but whether it had telescope sights or not I am not quite sure, was enabled to silence a gun. As soon as ever a gunner appeared at the embrasure he was picked off, so that one rifleman's fire with a muzzle-loader was sufficient to silence one cannon. Within the last year or two, telescopic sights have been brought to perfection and fitted to sporting rifles by Messrs. Fraser, of Edinburgh, who are also of opinion that they would be equally well adapted for military purposes. I believe that Sir Henry Halford with the new Martini-Enfield rifle has put as many as ten shots into a square of six or eight feet at 2,000 yards. That is with his own unaided vision, and with the naked sights on the rifle. How much better practice could we have made with the Martini-Enfield rifle if it had telescopic sights, I am not prepared to say, but in all rifle shooting we, of course, have the human body as a carriage, and that has been very aptly described by a well-known medical authority as a "palpitating mass," while in the machine-gun we no longer have this factor, but a steady platform for firing the bullet, and with uniform ammunition and a uniform state of the wind there would seem to be no reason why each barrel of a machine-gun should not put a series of bullets through the same hole. I therefore most respectfully submit that due attention should be given to the very practical suggestion made by the lamented and gallant Officer the late General Gordon as regards telescopic sights.¹

Lieutenant TUPPER, R.N.: My lord and gentlemen, I hope that the position I hold as one of the Staff Officers on board the "Cambridge," in which I am daily brought into contact with machine-guns, will be some excuse for my presumption in addressing so many distinguished and experienced Officers. In the first place, it has always appeared to me, since I have been Instructor and have been instructed myself in machine-guns, a notable fact that in our Service we have not got a single machine-gun. We have the quick-firing Hotchkiss, but we have not a single machine-gun in which No. 1 both lays and fires his own gun. In our musketry instruction we teach the seaman as a fundamental principle that the object of the third practice of position drill is to establish that union between the hand and eye which is indispensable to good shooting. When he has done his musketry instruction we take him to the machine-guns, where at once he has a different state of things altogether; there is no more union between hand and eye to be established. Union has to be established between No. 1's eye and voice and the hand of No. 2, who works the lever or crank. It is a remarkable thing that everyone has a certain amount of personal error. This was tested in the "Vernon" by an electrical apparatus. When you gave an order to a man you broke one circuit, and on acting upon your order he broke another circuit, and that showed the time the order took to penetrate his brain and make his hand work. When you come to fire these machine-guns on board ship, the ship is probably rolling. No. 1 looks along his sights and is to fire when he has a half sight. Just as the gun is rolling up he gives order to No. 2 to fire; No. 2 fires, he has a little personal error, and the shot goes wide of the mark, that is, over it. Time after time firing the Nordenfolt gun in the gunboat, I have found that I could not get the men to make good practice when they were firing

¹ A paper was contributed by Lieut.-Colonel D. Davidson, late of the Bombay Army, on his "Patent Telescopic Rifle Sight" in 1864. *Vide* the Journal, vol. viii p. 426, *et seq.*

what we call "volley firing." When I gave the order "rapid firing," and the No. 1 had to keep his sights on, and the gun was fired as quickly as No. 2 could work the lever, we got better shooting. I therefore think it would be advisable, if possible, to adopt the Hotchkiss system of mounting with the shoulder-piece for all machine-guns, and to do away with the somewhat complicated training and elevating gear which we now have in the Nordenfelt and Gardner system. Here before us is a practical illustration of the Hotchkiss mounting. It is a rigid mounting, a pair of trunnions on a vertical spindle, and in working it with the shoulder-piece, you keep your sights on by elevating the gun and training it at the same time with your shoulder, having your right hand on the trigger to fire the gun directly your sights are on. That is a principle which I think can easily be adopted in our machine-guns, and in that way you would secure the condition which is considered in musketry indispensable to good shooting. In the next place, as to the sighting. Hotchkiss introduced a sight by which No. 1 could pick up his distance at once. In the "Excellent" a similar idea was suggested recently: it consisted of a sight which was like a ladder and graduated up to some 1,200 yards; the thick rungs of the ladder were the even hundreds, and the thin rungs the odd hundreds. The sight is hinged at its base so that when not in use it lays flat on the frame—when you are firing the guns the sights stick up in the form of a ladder and then with distances rapidly altering, No. 1 could at once pick up the rung of the ladder corresponding to the distance at which he estimated the object to be. As we drill at present, we have a man each side of the gun to keep the sights adjusted. They have either to estimate the distances respectively, or else they have to get it from the Officer in charge or from No. 1. It takes some time to adjust the sights now in use to the various distances, and besides, Nos. 2, 3, and 1 may differ in their ideas. Therefore it strikes me that if you had this upright sight in the form of a ladder, so that on estimating the distance of the object, No. 1 could take his sight from the rung which corresponds to that distance, the speed and accuracy and efficiency of sighting might be increased. I see Captain Armit laid very great stress on the necessity of having men thoroughly trained in working machine-guns. I cannot too strongly emphasize his advice myself. In my position I cannot criticize the regulations for the instruction of the men, I have merely to carry them out, but I do not think I should go outside of my province if I placed the results before this Institution. I have questioned two or three men who were at Tamai and El Teb, and they said they did not see anything wrong with regard to the gun whatever, they only said that if they had known at that time what they know now about the details as to mechanism, and the faults that occur and the methods of rectifying them, that those guns would never have failed or jammed at the critical moment. I believe in the Gardner system thoroughly myself, I have seen a good deal of practice with it. We have a field Gardner gun in the "Cambridge" now, that has been working steadily for four years, and it has never had a misfire or jamb during the whole period, simply because the men who work it know how to manipulate it; it works very well, and it always gives good results. But I do not altogether like the Gardner gun as it now is. I think it is too heavy, but I think that the weight might be rectified. I do not see why it could not have a light steel frame and a steel box for the locks, instead of the heavy metal now in use; the barrels also are very big and clumsy, but I do not see why they could not be made as small and compact as those of the '45 Nordenfelt. What I do like about the Gardner gun is its great simplicity, and I always find in examining blue-jackets they do not make so many mistakes about the Gardner gun, they seem to grasp its mechanism easily. They do get a little mixed over the Nordenfelts, but the Gardner gun they always seem to be able to explain thoroughly; they can take a lock to pieces and put it together again in a minute. Again, if the cartridge does not extract properly and is jammed in the gun, all you have to do is to open the cover of the Gardner, take out the lock, and then you can go on firing your four barrels in less than half a minute; whereas with the Nordenfelt, if the cartridge is jammed you cannot remove your plunger quickly, and you must get the cartridge out of the barrel with a cleaning rod before you can continue the fire, and this takes longer than it does to take a lock out of the Gardner gun, and that is a distinct disadvantage in action. As a lubricant for these machine-guns I have

found vaseline of great assistance. I have put vaseline on these machine-guns, and in spite of using them constantly for drill for ten or more days without relubrication, they have been as clean in the internal mechanism as they were when it was put on. That is not the case with oil, which seems to dry up more quickly and clog more.

Colonel ALT: Lord Charles Beresford, my lords and gentlemen, having taken the interest which I have in the question of the use of machine-guns for infantry purposes, I feel it is, perhaps, incumbent upon me to make a few remarks upon the very interesting paper which we have heard read. While agreeing generally in principle with the lecturer, I have a few exceptions to take in detail to some of his remarks. I will not say anything about the relative merits of machine-guns, I have no doubt machine-gun makers can take care of themselves in that respect. I have studied them all, but have had more particularly to do with the Nordenfelt gun, and I have my own opinion with regard to it, which is a very favourable one. As to the jamming of cartridges, I have generally been present at Aldershot and elsewhere, when experiments have been made with our Nordenfelt guns. I have always had reports made to me, and I have carefully enquired into any cases of jamming or explosion that may have taken place, and have found that they have occurred with blank cartridges. It is very difficult to manufacture blank cartridges to fit and work accurately with the machine-gun, because they cannot be made of the same weight as loaded cartridges, and therefore they do not drop so readily or so accurately from the distributor into the breech, and occasional jams and hang-fires have thus occurred from faulty blank cartridges. I believe that when it is better understood and when used with loaded cartridges there will be found very few instances of jamming or hang-fire with the Nordenfelt machine-gun. With regard to the training of men, there can be no question that to work these guns the men ought to be properly trained. I do not agree with the lecturer in his view as to the establishment of a special Machine-gun Corps; my own idea is that every man in a battalion should be made to work these machine-guns. It is true that our men take about three months to learn the drill, but Volunteers only drill at irregular times at night, and I maintain that for men of the regular Service, a month at most would be quite sufficient to make men perfectly efficient in the use of machine-guns. Instead of a distinct corps every man of the battalion should be able to take his place in working the guns when occasion requires. The guns are of course of great use for defensive purposes; but I claim that for purposes of offence the guns would also be of great use. I have proved this at Aldershot and elsewhere, several years running. With the assistance of the gallant lecturer and other Officers attached to the guns, we have moved them up rapidly with the fighting line to demonstrate their mobility, and with most satisfactory results. For outpost work too they would be invaluable. I do not agree in the possibility of their being very readily captured, because our men are able to pick their gun up and run away with it as quickly as any rush could be made upon them by any fighting line if such an occasion ever arose. My reason for saying that every man of the battalion should be trained at the gun is that you cannot make omelettes without breaking eggs. You cannot carry fixed positions without making sacrifices. You never think anything of the sacrifice of men in seizing a position, and I do not know why you should make so much of the loss of one or two machine-guns if the occasion arose requiring it: therefore I maintain that they should be pushed forward in the fighting line where the doing so would be of advantage, and that any men of the battalion should be ready to take the places of those disabled at the time. Then with regard to the range at which these guns can be worked, one great advantage of the long-range firing at which they are capable of being used would be against artillery. I think we demonstrated that at Aldershot at the rifle ranges at Cæsar's Camp. On one occasion it was perfectly startling to see the effect produced upon volley targets by a few hundred rounds fired at ranges from 500 to 800 yards. Sir Archibald Alison, commanding the artillery at Aldershot, and a great many other Staff Officers were present, and I am sure they were impressed with the disastrous effects which would have been produced upon artillery deployed, by the fire of one machine-gun. By the use of a range-finder, the range is very easily obtained with the sights upon the guns or in the same manner as with shrapnel

shell fire ; upon any ground where the dust is thrown up or an explosion can be seen, you can pick up the range with machine-guns. You can begin at short range, and by gradually elevating your gun you can pump the lead along until you pick up the range of the artillery or other objects, and the effect that would be produced by the splashing of lead upon the guns, tyres, and limbers, and by direct hits upon the men or horses of a battery of artillery as far as it was exposed to view, would be very great indeed. Then with regard to the number of men, the lecturer laid some stress upon the fact of twenty men being necessary for the gun. These remarks might be misunderstood. No more than ten men are necessary for the working of a gun. It is quite true that if we want to keep up with a battalion in column of route over such ground as the Long Valley, or the Fox Hills, it is necessary to reinforce the gun detachment, by detailing a section from the leading company merely to do animal work of pulling up very steep inclines ; but for actually working the gun no more than the gun's detachment of ten men is required. If any of those men are placed *hors de combat*, other men at hand are immediately ready to work the gun, and so avoid the risk of the gun being rendered useless by casualties occurring in the detachment.

Major LOCKYER, R.A. : As Inspector of Small Arms I hope you will excuse me if I make one or two very brief remarks on Captain Armit's very excellent paper, with most of which I entirely agree. There are one or two points I think he has omitted, and the chief of them is that although I think he recommends that the men who are in charge of these guns should have a great deal of drill, he never says that it should be otherwise than with blank or dummy cartridges. Now, it has been my province to instruct a great many men in the use of these guns with bullet cartridges, and, of course, there being a large amount of ammunition at the Small Arms Factory, we can fire a great number of rounds. We find, although the men are perfect at their drill with blank or dummy cartridges, that when you get them to work the gun with an unlimited supply of ball cartridges, the gun jumps, makes a noise and much smoke, and for these reasons we find the men who can do very well with blank cartridge or dummies, when they first try with ball cartridge get the gun more or less jammed, and the fire becomes very intermittent, and in many cases it has been stopped altogether for some considerable period. I would, therefore, suggest that very strong stress should be laid upon this, that the corps which I hope will be formed should have a very large amount of bullet ammunition every year furnished to it. There is another point that Captain Armit mentioned about hang-fires and explosions in the magazine. I do not think in any gun that the action is rapid enough to extract a cartridge before it explodes, unless, of course, it has hung fire to a certain extent. We have known very few cases of hang-fires, but a man on one occasion had his fingers blown off when testing rifles for their extraction with a common Martini-Henry rifle, and therefore I think the hang-fire, which very seldom occurs, can hardly be taken into consideration where the mechanism of the gun is concerned. With regard to jamming the great thing to prevent it is, as said before, to practise the men with bullet ammunition. I do not think it is generally known, but in the Gardner two-barrelled gun there is now a very good arrangement by which if one barrel jams a small gun-metal plate is put behind the breech of that barrel, and that small gun-metal plate, without taking out the lock or anything, stops that barrel working altogether, and you go on working your two-barrelled gun as a one-barrelled gun. This is done within the space of a few seconds in the event of the jamming of one barrel.

Mr. NORDENFELT : I just wish to point out to the gallant Officer of the "Cambridge" that these two-barrelled and four-barrelled Nordenfelt guns are supplied with two lines of sight. The left line of sight can be used when one man aims the gun and another man fires, and the right hand sight is specially provided for use when one man both aims and fires. That is done so in the "Excellent ;" I do not know why these instructions have not reached the "Cambridge," but I will inquire about it. As to the lecturer's statements, I like the bulk of them very much, though there are a few things I do not like. There is one statement which I think it is fair to a foreign Government to explain. Captain Armit says that it is wrong to compare revolving guns with rifle-calibre guns, as was done in Russia. In Russia these trials were not between shell guns at all, they were between the Gardner, my

own, and other rifle-calibre guns. It was then proposed, either by the Hotchkiss Company or the Government, that a 37 mm. Hotchkiss gun should be fired side by side with the other guns for the purpose of seeing whether a gun firing small shell might be used under circumstances when the rifle-calibre gun would be useful. It was not a competition between rifle-calibre or shell guns in any way, it was simply that the Russian Government wished to know whether a small 1-pounder shell-gun would practically be as effective as the rifle-calibre guns then in competition. I believe the lecturer's memory has misled him with reference to the explosion which he mentions in one of my guns at Aldershot. I have a letter from the Officer whose trousers were singed, and who states that on that occasion the gun was firing blank ammunition and not bullets. Lord Charles Beresford will remember what occurred at Dartford where we fired blank ammunition; it was very badly made, put together temporarily as a means of trying the gun when moving about in the presence of a number of Officers, and therefore I beg to say I do not consider that is prejudicial to the gun in any way. I quite agree with the lecturer where he states that rifle-calibre guns, as well as shell-guns, would probably be necessary in the field. I would like, however, to state that in using the words "shell-guns in the field," I would eliminate every and all guns which do not fire shrapnel. It may take some time before shell-guns do come in for field work, but we fired last year in Sweden for two months 3-pounder shell-guns with common shell as well as shrapnel for field use, and we found common shells practically useless, even with as big shells as 3-pounders, at 2,000 and 3,000 yards. The common shells exploded often into the ground, or exploded behind something, and then you did not see much of them. I believe shell-guns in the field will be bound to fire shrapnel, because then the distances soon become known, as instead of waiting to see the actual explosion in the ground you see them explode in the air, and the effect against troops was found to be very much greater than that of common shells. That excludes all guns which are of less calibre than nearly 2 inches. I believe that guns as small as $1\frac{1}{2}$ inch firing shrapnel would not be much more useful than rifle calibres, but at the same time as soon as you get to large calibres shrapnel is a great advantage. We fired at Portsmouth the other day 6-pounder case shot with 1,800 feet velocity, and the killing range was about 400 yards. That means that with a 1-pounder shell like the revolving cannon fired in Russia with 1,390 feet velocity, the killing range would be probably less than 250 yards. These case shot in the field are quite admissible and useful if you come suddenly into very close quarters, but not otherwise, and one must absolutely look forward to shrapnel for that purpose. There is no use in making shrapnel shells for anything under $1\frac{1}{2}$ inches calibre. There is one point I would like to mention about sufficiency of ammunition. When a gun fires from 500 rounds to 1,200 rounds a minute and you begin to add that up, it appears to be an awful lot of ammunition; but I have never yet seen any firing against moving objects or at any respectable range where the rapidity of firing ever exceeded one-third of the maximum rapidity. I consider that the five-barrelled gun for instance, be it Gardner's or mine, would in war practically fire something like 180 to 200 shots a minute. You blaze away for a second or two, then either you have killed the objects you have aimed at, or there is a movement or something comes between. During the experience in Egypt I am told that on no one day in the field, taking the whole day, and there were occasionally some uncommonly hot hours, was there a greater maximum than 1,300 rounds fired from any one of the machine-guns. I believe, therefore, with Lord Charles Beresford, in making the guns as movable as possible, that all you need to carry is about 1,000 rounds in the hoppers, and about another 1,000 to 1,500 in the usual cartridge pockets. That does away with a great deal of the dangerous idea that 10,000 rounds or more are required, which means putting four or six horses to a gun like that. I may also say that while we machine-gun-makers no doubt make a great point of our guns being exceedingly simple, still the simplest possible mechanism requires more training than is generally given to machine-guns as yet.

Colonel LIDDELL, 10th Hussars: I should hardly venture to make any remarks before an audience of this kind had it not been that at the several discussions which have taken place on the subject of machine-guns in this room no one of my branch of the Service, to the best of my belief, has spoken. From this fact it may

possibly be thought that the cavalry branch of the Army does not value this machine-gun, or rather rifle, or appreciate the immense future that appears in store for it. I therefore wish to say no more than this, that a great many of my brother Officers in the cavalry do value it most highly; in fact, we think our branch of the Service is the one above all others to which these guns should be attached. When we are far in advance of an army waiting for infantry it is very often an anxious moment, as any cavalry Officer knows; this gun would then supply the want of infantry till they came up, and therefore would be most invaluable to us. Besides the many contingencies in which they would be of use, I am of opinion that tactically they might be freely employed. Supposing one body of cavalry was about to charge another, the one that had two of these guns on its flanks and could send some thousands of rounds into the approaching cavalry would very much shake it. I am happy to say that the chief of my branch of the Service, Sir Drury Lowe, is a most anxious advocate that these guns should be tried, and I hope, as the regiment to which I belong is at Aldershot, we may be allowed the opportunity of doing so in the coming summer.

Captain ACLAND, R.A. : My lord and gentlemen, I think the only arm that has not been represented in this discussion is the gunner's. There is a great deal I should like to attack, as a gunner, in Captain Armit's lecture, but I shall not do so. I would not prolong the discussion at all, but as a practical Officer I have been engaged at Shoeburyness in trials of all types of machine-guns, and should like to comment upon one paragraph which Admiral Boys has not alluded to. Captain Armit seems to object to the intermingling of types, and to the adoption of different systems of guns in the Service. He points to our having Krupp, and French, and Armstrong, and Whitworth guns. Surely no one would wish the authorities alone to be the sole judges of what should be adopted in the Service, for it is only by having every kind of gun tried in the Service, and by practical Officers working out the details, that the authorities can possibly decide which is the best system. At Shoeburyness, of course, we have every conceivable invention, good, bad, and indifferent, under trial. Lieutenant Tupper of the "Cambridge" pointed out that he should like to see the ordinary machine-gun with the Hotchkiss shoulder-piece. If a sporting man is behind it I quite agree with him; if a duffer is behind it he had much better have the Nordenfelt traversing and elevating arrangement. Even in his own Service there are plenty of men who will disagree on that point. It is only by bringing questions such as these before practical men, and by "intermingling types," that such questions can possibly be settled either for my branch of the Service or for the Navy. I think that is the special point to which I wish to draw attention, as well as to Captain Armit's rather antiquated ideas as regards case shot. I hope case shot in a few years will be obsolete; but the effective range of case shot from the new type B.L. gun is certainly more than 300 yards. No doubt shrapnel shell will take the place of case shot entirely, being burst with a time fuze at the muzzle.

Rear-Admiral FREMANTLE, C.B. : I think, my lord, it would have been advisable if the lecturer could have given us a little more completely his ideas with regard to the machine-gun afloat. As we must look to the machine-gun as one of our principal defences against the torpedo-boat, it is very satisfactory to see how the machine-gun is advancing daily, and how many types there are already in existence, as well as the changes which those types do take from time to time. The Hotchkiss gun exhibited to-day is a very different gun from any Hotchkiss which we have ever seen before, and we also hear of different types of the Gardner gun, which certainly do not resemble those with which I am acquainted. I have had a little practical experience of machine-guns, and I have been wishing to speak with a view of stating very much what has been stated by the last speaker, that what we really look to is the question of the experience of those who have tried these guns, and especially those who, like our Chairman, have had the opportunity of trying them in action both on board ship and in the field. That I think is the really important question. So far as my own experience goes, I had the honour in the "Invincible" at the end of 1879 of taking out the first six real machine-guns, the first six Nordenfelts sent out to the Mediterranean. I do not speak of the Gatling, because that we all admit is dead and buried, but the first of those guns which

were at all events supplied to the Mediterranean fleet went out in the "Invincible," and consequently our men had had little or no instruction in the use of the Nordenfelt gun. I am bound to state that those guns were always, as far as I recollect, very efficiently worked, and that we had no accidents, no jams, or, at all events, very few jams, connected with them. I think it is due to the Nordenfelt to make that statement. There were some alterations made to them afterwards to the extent of preventing them from being fired when at half-cock and so on. When I commanded the "Dreadnought" last year she was fitted with ten Nordenfelts and four Gardners. I want particularly to guard myself against advocating any particular type of weapons. They are improving from day to day. The advantage which there is in one type is an advantage which is not shared by another, and *vice versa*. I have heard it stated that in the lecturer's opinion there is a great advantage in the horizontal motion in firing the Nordenfelt gun over the rotary motion used in the Hotchkiss. I am inclined to agree with him there. I think anybody who looks along a line of sight and sees something constantly moving round and round must find it more difficult to take aim; at the same time, we have the high authority of Admiral Boys for a different opinion, and therefore you see in these matters there is a great deal of room for difference of opinion. But I wish to state, as far as my experience goes in the "Dreadnought," there certainly was some trouble caused from time to time by the Gardner gun. Here, again, I am differing in opinion from Lieutenant Tupper, who has had great experience in the "Cambridge." But I should like especially if the Chairman would kindly give us his experience on this particular subject. I have worked with the Gardner gun, and it has always struck me that in the desert or wherever there was any amount of dust it was certain that some of it must get into the Gardner gun, and so prevent the cartridges falling into their place and impede the firing of the gun. Perhaps I am wrong about that. We have had Lieutenant Tupper's opinion that the Gardner gun is perfection, and cannot get out of order. I do not wish to say anything against the Gardner. I did remark that it did fail occasionally to feed properly from some little dirt having got into the feed, and I wish to know from our Chairman if he will kindly tell us whether that was the cause of the jamb which did take place in the Soudan, and if so, whether it could not very easily be obviated by having a closed hopper.

Colonel HOPE, U.C.: I wish to say a very few words, with all deference to what fell from the last speaker but one about the suggestion of having guns of all kinds tried in the Service. No doubt it is a very great advantage. Unfortunately that is just the advantage that the Service is without. The Ordnance Department set their faces resolutely against all inventions in the way of larger ordnance not emanating from Woolwich or Elswick, and nothing is more disastrous than the history of rifled ordnance in this country, unless perhaps it be that of machine-guns.

Mr. ACCLES: My lords and gentlemen, I wish to make a few remarks in respect to the Gatling gun. I have been connected with it for the past fifteen years. It seems to be the prevailing idea that the Gatling "is dead." The Gatling is not dead. It is one of the most lively guns you ever saw. Since the Shoeburyness trials the Gatling has received new life and is again to the front. I have remodelled and rebuilt it. It is altogether a new gun. There is little left of the old gun except the name. It has not yet had a chance to be in competition to any great extent in England, but in other countries where it has been in competition it has always carried the day. It is not necessary that I should remind you, gentlemen, of the good service done by the improved Gatling in the late troubles in the North-West of America. Should there be another competitive trial, you will find that the old or new Gatling will do its duty. I have in remodelling the gun made every movement positive. The extractors and the feeds are positive in all their movements. The cartridges are under control from the time they are placed in the feeds until the fired shells are ejected from the gun. There are no springs in the gun except those in the locks which drive the firing pins forward. If the gun was never fired at a less rate than 300 shots per minute, I could do without them. The cartridges are received from the feed at the top of the gun and fired at the bottom, so in case of hang-fire cartridges the gas or fire cannot reach the live cartridges in the feeder and cause an explosion. Take all the jams and mishaps, and the number of cartridges that have been fired

from the old Gatling, of which I have helped to fire 2,700,000 rounds, I certainly never knew of a man to be shot or disabled at the rear end of the gun. You will see this proves that the system is at least a safe one. While attending a lecture on machine-guns, by Lord Charles Beresford, in this lecture-room, I found that one of the chief wants was a suitable mount or carriage for a machine-gun. I have designed a carriage with three wheels. The first one I made is to be seen in one of the other rooms. I have arranged the gun so that it has an all-round fire without moving the carriage: it can be given an elevation of 83 degrees for high-angle fire. The gun can be fired while the carriage is on the move. The man who fires the gun rides on the trail. He points the gun by means of a long lever passing under his left arm and turns the crank and fires it with his right at the same time. 5,000 cartridges, 10 feeds, and a tripod are carried on the carriage with the gun. The tripod is intended to be used to fire the gun from in any place where the carriage cannot go. I wish to say a few words about high-angle fire. I am confident that in future warfare it will be a useful and necessary feature in a machine-gun. I have proved by a number of trials with the improved Gatling, using my feed, that it is practicable at all ranges from 200 to 300 yards (elevation from 38 to 82 degrees, penetration from 3 to 6 inches of wood). Intrenchments or breastworks would be no protection whatever; a body of men would very soon become demoralized if not disabled by a shower of bullets falling on or among them. Some time ago I made a trial near Vienna; when finished the Committee said to me,—“You have shown that the gun will do all you claim for it, but there is one great defect in using bullet-firing machine-guns; you cannot tell whether you are hitting the mark or not. With a shell-gun you can see the shells explode and know just where you are.” I asked them, “How do infantry know?” I am sure that a machine-gun has the best chance of the two. I said, “Bring out your shell-gun and I will take the Gatling, and we will have a try for 30 seconds at any guessed distance under 3,000 yards.” They did not bring out the shell-gun, but they set up a mark for me, which I guessed to be about 2,200 yards. I set the stops on the elevating arc so the gun would oscillate vertically between 2,000 and 2,500 yards. I also gave it about 30 yards horizontal oscillation. I fired 500 rounds in the 30 seconds, and made 17 per cent. hits (target 6 × 20 feet). The movement of the gun was just like sprinkling water out of a hosepipe. I will leave you, gentlemen, to judge whether a shell-gun with its requisite number of men could do any better in the same time. Before I take my seat, I beg to deny that any such trial has ever been made with the improved Gatling gun positive feed before any North American Indian Chiefs, as stated by Captain Armit. Can you imagine a metallic cartridge hanging fire long enough to pass through a gun and drop on the ground before going off?

The CHAIRMAN: Before calling upon Captain Armit to reply, there are a few observations which I should like to make. I notice in the paper the lecturer says that there is rather an uncertainty as to the meaning of the term “machine-gun.” I do not quite agree with him there, because I think a machine-gun is a gun without recoil, that when once you get your sights on you can keep on firing at your enemy as long as it is kept charged. That is the meaning of a machine-gun. Some are rifle-calibre machine-guns, and some are shell-guns, but that is the actual meaning of the words “machine-gun.” He also speaks about the machine-gun, rifle-calibre, mounted as a field-piece with a limber. Captain Wilson, who gained the Victoria Cross in the Soudan, devised a method of mounting the gun on two wheels in very much the same manner as that shown by Colonel Alt. When we went up the Nile the other day we asked Captain Wilson’s permission to mount our two guns in the same way. We left the limbers at Cairo; we took our guns on the two wheels. There was a light pole across the trail which Nos. 3 and 4 carried, and when we were near the enemy, the muzzle was always to the front; that is to say, at the word “Action!” 3 and 4 dropped the trail; the gun was immediately in action, and the feed was on the gun with the cartridges in it. As the arc of fire, or the points within which a rifle-calibre gun is useful, is only the range of infantry fire, it ought to be always in action at any moment, and therefore the questions of unlimbering, shifting your carriage, and getting the machine rifle-calibre gun into action, the same as you have to do with a field-piece, to my mind, do away with a great deal of its efficiency. I am delighted to hear from the branch of the Service

represented by Colonel Liddell that they are going to take up the machine-gun and try and use it on a galloping carriage. Some years ago Mr. Nordenfelt assisted me to mount the gun on a galloping carriage, so that the gun would train over the wheels perfectly clear, in other words, so that it was always in action, and I compared that gun very much to what a torpedo-boat is to us at sea. You may try to get it into position, and you may lose its detachment, but you only lose five men, and you only lose the gun. But look at the enormous amount of mischief which it can do, and how efficient it can be if once you get it into position! It is the same with the torpedo-boat. The probability is it will never get near the ship, but if it does get near the ship, it is a great nuisance to that ship. The question comes, after all, to this: How are we to mount these guns? Colonel Alt has mounted his gun in a most excellent way, and other mounts have been proposed. That is the real point we have to think out. I should like to tell you how we carried our guns in the Soudan. We carried them on four camels, each camel and each gun numbered, and each camel had so many men told off to it, all numbered and named. The blue-jackets called them different names, naturally, but they went by numbers in the book. No. 1 carried the barrels; No. 2 carried the training and elevating gear, the feed-plate, and the wheels; No. 3 carried the trail, which was very heavy (it was an iron trail supplied for the machine-gun); and No. 4 carried four boxes of hoppers full of ammunition. Of course we only got to Korti say on the Monday, and had to start on Wednesday morning. We had not much time to drill, but whenever we halted we had a little drill, say for ten minutes every night. We found that after the order "Halt!" we had to get our camels down—it took some time for the men to get accustomed to the camel, and the camel to the men; but from the order "Halt! mount the gun," we used to be able to form the order of march under three minutes, which was very quick considering we had to connect the elevating and training gear. I am not going to be impertinent enough, with so many soldiers present, to refer to what the tactical positions of these guns should be, whether they should be attached to the cavalry, the artillery, or the infantry; but I do most earnestly hope that all the branches of the Service will give them a thorough and fair trial. If I might suggest how I might work them if I was on shore, which I might be some day, I think I would divide them into batteries of four guns, for the simple reason that the battery of four is more distinctly under control than the battery of six. You would have a leader to each subdivision, and would always instruct them to work independently as skirmishers, and never in line either ahead or abreast. Sir Redvers Buller says that these guns are useful in defence but not in attack. I think they would be useful in attack, particularly as an adjunct to the cavalry, mounted on a galloping carriage. However, I am sure that nobody here will think me egotistical in referring to a fight that we had on a steamer in the Soudan. That was a distinct attack. We were in a steamer that could only go two knots against the stream. The range of the guns in the fort that we attacked was about 3,000 yards. It was a low fort, very difficult to hit, but fortunately it had embrasures. We had our two guns mounted *en échelon*, so that they would fire both broadsides clear. We went up to that fort, and although there were hundreds of riflemen on the bank, and the natural thing for the men to do would have been to fire at the riflemen, what we instructed them to do was to keep pumping lead into the fort, and the consequence was they could not hit us with their shot. The hail of lead prevented them hitting the steamer. We passed within 80 yards of those three guns, and they could not fire at us. As you know perfectly well, it was a sort of penny-boat really, very thin, worn out, like one of the boats on the Thames here. The proof of what I am saying is this, that there was a moment when the two machine-guns would not bear, and at that particular moment, only some 200 yards after we passed the fort, when we were giving three cheers, thinking that we had done a very fine thing, and when the machine-guns would not bear, they hit us two or three times, and one shot went into the boiler. It was therefore a distinct case of attack, and it is to the attack of those two machine-guns, in my opinion, that we owe our lives, and not only ours but those of Sir Charles Wilson and his party. I think if we had had only one machine-gun, we could not have played on the fort with the same effect that we did. I do not think any of us would have come back; in fact I may say I

am certain that neither Sir Charles Wilson nor any of his men nor ours would ever have got back. I mention this to show what I myself think of the machine-gun, for attack. Sir Charles Wilson might have marched down the bank, but he had three very strongly fortified villages to pass, and he had only twenty English soldiers. He had also 200 of those men who really wished to get back to the Khartoum which they had left.

Admiral FREMANTLE: Were those Gardner guns?

The CHAIRMAN: Yes.

Admiral FREMANTLE: What has your lordship to say about the feed of the Gardner? It is open in front.

The CHAIRMAN: I do not like that feed nearly so much as the Nordenfelt feeds but my own experience is that you can make better practice and keep on firing better with the horizontal lever than you can with the rotary motion. The rotary motion, especially with a gun mounted light, throws it out of gear every time, so that it ceases to be a machine-gun. In other words, you have to keep on relaying it almost every time. The gun is too light for the strain on the lever. With the Nordenfelt gun that does not occur at all. I have such a firm belief in these guns myself, that I have used all the energy I have to try and get them forward, and my efforts have been very well backed up by many very distinguished men in the sister Service. The artillery, I am very glad to see, are coming forward, and as to the cavalry, we have a Colonel with us to-night who says that he will try his best. Lord Wolseley also has given them a very great immediate future. I have heard him say myself that any European army that will have these guns, with thoroughly drilled men, and with smokeless powder, is certain to win the victory in the next war. That is a very strong opinion from a very eminent man. I can only say, as far as I am personally concerned, I have such faith in them that I would to-morrow rather command six batteries of these guns on shore than I would the finest iron-clad in the Navy with a chance of a brilliant action.

Captain ARMIT: Replying to the remarks that you have been good enough to make upon my poor endeavour to bring the machine-gun before you, allow me to state that I desire, in the first place, to make no aspersions on either Sir Frederick Campbell, who has been called an obstructionist, and who has a will of his own—we all know that—or the Machine-gun Committee, presided over by Admiral Boys. I was at Shoeburyness, and saw and heard certain things and drew certain conclusions from what I saw and heard, but I am very glad to hear to-night that those conclusions are incorrect.

My argument is that all guns should have a fair trial in the Service, and that Officers who have to use these guns, and risk their lives in the defence of their country, and those guns, should be allowed to decide which they would prefer to use in action. I think Captain Acland has rather misunderstood me. I wanted to impress upon you that in my opinion when the country goes to war the Service should have one arm to defend itself with in every branch of the Service, that it should not have a dozen different systems and types of machine-guns, a dozen different drills on board each ship, or in the field, and I perfectly agree with Captain Acland that you may try every one of them in peace time, but you should be prepared, before you go to war, to arm the Service at all points thoroughly and well, and not to have a multiplicity of arms and drills, such as will render the ship a regular Tower of Babel, because in a ship, as well as in a regiment, a battalion, or corps, if you have such a number of drills, arms, and ammunitions to serve, you may have the wrong ammunition up at the wrong time and in the wrong place. With regard to Colonel Alt's remarks, of course I shall be very careful in what I say, as he is my Commanding Officer. Allow me, however, to say that the explosion I referred to at Aldershot was an explosion that took place at Whitsuntide, in the presence of Sir Archibald Allison, and they were ball cartridges that exploded. It was not so much the fault of the gun as of the ammunition, which, by being carried about in the limber carriage, gets knocked about; the bullets, loosened, allow an air-space between them and the cartridge case, and the flame of the cartridge exploding by being suddenly extracted before it has actually been fired, may explode others in the hopper, as it appears to me was the case in our explosion. As to the American hang-fires not exploding on the ground, I derived my information from a Lieutenant of the American Navy, and

also from a Commodore, both of whom said they were present and saw it happen. Mr. Accles, the agent of the Gatling Gun Company, says that it never did happen, and therefore I can only conclude that my friends were mistaken. I must mention that Captain Wilson, U.C., inspected our guns at headquarters. He inspected Colonel Alt's carriage with the present Director of Naval Ordnance after El Teb and Tamaai, and designed his two-wheeled magazine carriage after having seen Colonel Alt's carriage. I was present when the Director of Naval Ordnance visited our headquarters. I had the men with the carriages before him, and that was long before any such carriages were introduced into the Navy, and Admiral Hopkins states that it was entirely to Colonel Alt that we owed the introduction of this carriage into the Service. With regard to Lord Charles Beresford's experience of machine-guns, I must at once submit that his having used them in action is far better than my having simply seen the old Montigny used in action, and also I would remark that I regard machine-guns myself, and my paper will show it, as being as useful at times in attack as they are in defence ; but, on the whole, I regard the rifle-calibre machine-gun as a defensive weapon more than an offensive one, while I regard the shell-firing gun as an offensive weapon rather than as a defensive weapon. Allow me, in conclusion, to thank you all for the kind manner in which you have received my paper, and to thank Lord Charles Beresford for his great kindness in presiding on this occasion.

The CHAIRMAN: I hope you also will allow me to thank Captain Armit in your name for his very able and interesting paper.

A MACHINE-GUN BATTERY AND ITS EQUIPMENT.

(Communicated by Lieutenant G. E. BENSON, R.A.)

I.—*Employment of Machine-Guns in a Battery.*

MY experience of machine-guns is not very extensive, having been chiefly acquired in the Suakin Expedition of this year; during this time I was attached to the Royal Marine Artillery to assist them in forming a Gardner gun battery drawn by mules on field battery lines, and for the short time I served with this battery ample opportunity was afforded me for thinking over the question of machine-guns and their use, and of watching their effect in the field, with a view to find out the best tactical use that can be made of them in future campaigns; and from what I then saw I feel convinced that a great field is open to them, provided that in future they are equipped in a manner more suited to their powers.

Machine-guns have not hitherto been given the same chance as field-guns; for, when more machine-guns than one have been employed in the field, they have as a rule been separated; so, if one got out of action either from being disabled or jambed, the consequences were serious at that point simply from the fact of its not having the support of other guns. One might as well separate a battery of field-guns by sending each gun to a different place to fire at different objects; for, as I will afterwards point out, machine-gun fire partakes more of the nature of artillery shrapnel fire than of infantry fire.

The formation of the Gardner guns into a regular battery in the Suakin Expedition is no doubt a great step in advance, yet in my opinion it is only *one* step, for the real value of machine-gun fire depends on the rapidity with which they can be moved up and brought to act on any desired point of the field of battle. The only occasion on which the Gardner battery came into action against the enemy when it was not in a defensive position in a zareba, was in the action at Hasheen on March 20th, 1885, on which occasion the guns were run out at the left rear corner of the Guards' square, and opened fire into the scrub at 200 to 300 yards range, whence some of the enemy were annoying us by their fire. After a few rounds the enemy were silenced. Again on the retirement of the force later on in the day the battery was ordered to go outside the square and assist to cover the retirement. This we did by coming into "action rear" on the flank of the square, and firing at the enemy till we were left 30 or 40 yards in rear; then we limbered up, and hurrying along (the men being dismounted we could not go very fast) came into action again on the flank of the square. The enemy at times followed us at a distance of 300 to 400 yards, but did not show themselves much in

the open, except at a much longer range; however we continued our fire as long as we saw them.

Our fire was much hampered by the necessity of limbering up almost immediately after the square passed us; for, as our men were unmounted, we could not retire much faster than the infantry, thus we could never remain long enough in action to make our fire really effective.

If the guns had been drawn by horses, and the gunners mounted on the carriages, we could have taken up each successive position much more rapidly, and it would have been safe to remain longer in action after the square had passed us, thus the whole time of remaining in action would have been increased and the effect of the fire much greater.

At Tamai, the Gardner battery was left with one infantry battalion to defend the zareba, so did not have a chance of coming into action; but as I accompanied the advance on that day, I took note of occasions when the battery might have been employed with advantage.

Several parties of the enemy were firing at us at distances of from 700 to 1,500 yards, and I feel sure that once the range were found (as it speedily would be) a shower of bullets from the machine-gun battery would have silenced those parties that were beyond the limit of infantry *aimed* fire, much sooner than it could be done by the *unaimed* infantry fire.

The affair at Hasheen on the 20th is almost the only occasion, I believe, in which machine-guns have been used as a battery acting independently; and this, I take it, is the proper way to employ them. It is all very well to place them to sweep defiles, or at the salients of redoubts when occasion requires; but by confining them to those uses the principal advantage of machine-guns is lost, viz., their mobility. Now, when drawn by mules with the detachments marching alongside, they still cannot move faster than infantry, and (as happened at Hasheen) neither dare they trust themselves far from infantry, nor can they change position with anything like sufficient rapidity to make the most of their fire; for, of course as with artillery, the more time spent in taking up a position, the longer they are out of action and valueless.

The action of machine-guns, as I said before, partakes more of the nature of artillery shrapnel fire than that of infantry fire for the following reasons:—

- 1st. The fire of a battery of machine-guns being aimed by only one picked man per gun is immediately under the control of the Commanding Officer of the battery, who can at will turn his stream of bullets on any spot within 1,700 yards, and form a zone of fire in which no troops could live, just as a battery of artillery sends a smaller number of bullets a greater distance by means of shrapnel shell.
- 2nd. Infantry aimed fire ceases at 900 or 1,000 yards, while machine-gun fire can be aimed and under control up to 1,700 yards at least.

3rd. Infantry fire, necessarily from its extended front, cannot be directed on one special object so easily, and in individual firing (from nervousness, bad shooting, &c.) a very large proportion of bullets must go astray; while machine-guns like field-guns have no nerves, and their bullets never fall very far apart.

4th. Machine-guns can have the mobility of horse artillery, as before mentioned, if properly equipped.

At Suakin, about the end of March, we had some target practice with the four five-barrelled .450 bore Gardners which we were then using, and the results I think are worth noting here.

The target was a canvas screen 4 feet high and 10 yards long, and we opened fire at what we guessed was 1,050 yards, a range at which infantry fire is no longer aimed. After a few rounds we saw, by the amount of dust knocked up in front of the target, that our range was too short, and increasing the elevation to 1,100 yards fired about eighty rounds per gun. We then limbered up, retired, and came into action at 1,200 yards, when we again fired about eighty rounds per gun. I then rode up to the target, and was surprised to find it literally riddled with bullets. There wasn't a place where a man in any position whatever could have escaped. We afterwards advanced nearer, to about 800 or 900 yards range, and after a few more hundred rounds per gun the target was practically cut to pieces. It was unfortunate that on this occasion we could not try the guns at a longer range than 1,200 yards. The great fire effect at 1,100 and 1,200 yards range is of course due to the combined action of the four guns under one man; and though there were several jams, caused by the extractor pulling the base of the cartridge off, the other guns kept up the fire while a jamb was being remedied. It was discovered by the Marine Artillery that the best method of rectifying a jamb of this description was by putting a pared bullet in the muzzle of the jammed barrel (just small enough to go down) and pushing it down with the cleaning rod so as to catch the edge of the cartridge case and force it out. But our object in the future is to have a machine-gun which will never jamb. It is only with a view of suggesting the manner in which they should be employed when perfected that I write these pages.

II.—*The Equipment of a Battery.*

On the return of the force from Tamai, we took over four of the new two-barrelled .450 bore Gardners sent from Woolwich (sufficient men not being available to man the six provided), but unfortunately during the time I remained with the battery we had no brush with the enemy to test their efficiency in the field, so that my experience of these new guns is small. I hear, however, from an Officer who fired several thousand rounds out of them at Shoeburyness, that they never jamb.

The points I noted about their equipment which might be improved on are as follows, viz.:—

The axis of the gun is too high above the ground (about 4 feet); this entails less effective fire at short range, for in sweeping a plain or glaxis, the bullets leaving the bore 4 feet above the ground would have a trajectory in a range of 300 yards which would go over the head of a man 200 yards distant. If the axis of the gun were only 3 feet 3 inches from the ground, the highest point of the trajectory would be 9 inches nearer the ground, and the fire would be more effective and sweeping. The great height of the gun causes another important defect, in that it entails the No. 3 of the detachment (who feeds the gun) having to stand on a step to reach the top of the feeder during the time the gun is in action; he thus forms a most conspicuous object for the enemy to fire at. It would be better too, if it could be so arranged, for the feeding number to stand in rear of the axletree instead of in front, and for a folding shield to be fitted on the axletree for his protection. This would reduce his exposure to a minimum. For savage warfare this of course is not so important, as savages are seldom good marksmen.

It struck me, and the same idea was shared by every artillery Officer at Suakin who saw the new guns and their equipment, that the carriages were a great deal too heavy for the guns. The trails and axletrees especially (both E. O. C. and R. C. D.) appeared almost strong enough to withstand the recoil of a 9-pr. gun. Of course, with machine-guns there is no recoil which causes any strain worth mentioning either on the trail or axletree, so all that is required is a trail strong enough to sustain the strain of draught over rough country, and an axletree strong enough to carry the gun and fittings (and men if mounted on axletree seats) under the same conditions.

The traversing and elevating gear appear perfect and are a great improvement on the gear of the five-barrelled guns we used at first.

I will now proceed to give my ideas in detail as to the best method for equipping a battery of machine-guns.

The battery might consist of either four or six guns. The advantages of a four-gun battery are, that it would be handier and would seldom have to be split up on the battle-field. It is also a convenient number to put into a redoubt if used for passive defence. On the other hand the men required to man four guns would barely be sufficient to carry on the ordinary guard and picket duties of a battery. Of the *matériel* let us first consider the gun-carriage and limber. For these I suggest the following figures:—

Axis of gun 3 feet 3 inches to 3 feet 6 inches above the ground.
Wheels 4 feet 8 inches diameter.

Track 5 feet 2 inches (as in present carriage).

The axis of the gun might be lowered by means of crank in the axletree, also by reducing the height of the "crosshead" on which are the elevating and traversing gear. Axletree boxes with guard-irons, &c., for seats to be provided, each box to hold 500 rounds of ammunition in holders. Thus a thousand rounds would be immediately available in case of sudden attack.

The gun, filled axletree boxes and fittings complete, would weigh about $4\frac{1}{2}$ cwt. A folding shield might be added to each axletree box to protect the gunners when in action, this would make the total weight to be supported by the gun axletree about 5 cwt. The feeding should be done from the rear of the axletree; to do this the gun would have to be set a little further back in the carriage at the expense of making the point of the trail a trifle heavier to lift. The arrangement for keeping the barrels cool would be the same as in the present two-barrelled Gardner, as would also the admirable plan by which the feeder is always kept secured to the gun.

The limber might be similar to the present one, except that I would recommend the limber-box to be made longer and narrower, and fitted with guard-irons and hand-straps in order to seat two gunners; the box should hold at least 3,000 rounds in holders, as in the present carriage.

The spare part box should be carried on the wagon to lighten the load for the gun-team to pull as much as possible.

The weight of the limber-box packed, together with intrenching tools, would be about $4\frac{1}{2}$ cwt. The gun-carriage, and limber stripped, should not weigh more than about $11\frac{1}{2}$ cwt. This would make the whole weight of the gun-carriage, and limber packed, about 21 cwt. With four gunners mounted the total weight ought not to exceed $26\frac{1}{2}$ cwt.,—a load which four horses would be able to drag quite as fast as Horse Artillery.

For the carriage of ammunition I think one wagon per gun, fitted up much in the same way as an artillery ammunition wagon, would meet the usual requirements. On the wagon limber would be a box containing 3,000 rounds in holders as in the gun-limber. On the wagon body there might be two boxes, each with 2,000 rounds in holders, while the spare part box might be carried on the footboard. All the ammunition boxes should be fitted with guard-irons and hand-straps for seats. The weight of the ammunition boxes filled on the wagon-limber and body, together with the intrenching tools and spare part box, would come to about 11 cwt. Allowing 12 cwt. for the stripped wagon-limber and body, the weight of the wagon packed would not exceed 23 cwt., which with four gunners mounted would become $28\frac{1}{2}$ cwt. This also could easily be drawn by four horses.

The sergeants and coverers of each gun would be mounted on horseback.

The weights I have allowed for the stripped carriages in the above estimate may seem too low to some people, but it is my opinion that in this age when steel is so extensively used there would not be any difficulty in keeping the weights below those estimated, viz., $11\frac{1}{2}$ cwt. for the stripped gun-carriage and limber, and 12 cwt. for the stripped wagon body and limber.

The following would be the war strength of a battery of machine-guns equipped as above :—

Officers and Men.

| | Four-gun battery. | Six-gun battery. |
|------------------------------|----------------------|---------------------|
| Majors | 1 | 1 |
| Captains | 1 | 1 |
| Subalterns | 2 | 3 |
| Sergeant-major | 1 | 1 |
| Quartermaster-sergeant | 1 | 1 |
| Sergeants | 4 | 6 |
| Corporals | 4 | 6 |
| Bombardiers | 4 | 6 |
| Gunners | 28 | 42 |
| Drivers | 34 | 42 |
| Trumpeters | 2 | 2 |
| | <hr/> | <hr/> |
| | 82 | 111 |
| Artificers— | | |
| Farriers | 1 | 1 |
| Shoeing-smiths | 2 | 3 |
| Collar-makers | 2 | 2 |
| Wheelers | 2 | 2 |
| Armourers for machine-guns.. | 1 | 1 |
| | <hr/> | <hr/> |
| Total Officers and men .. | 90 | 120 |

Horses.

| | Four-gun battery. | Six-gun battery. |
|------------------------|-------------------------|---------------------|
| <i>Riding—</i> | | |
| Officers | 6 | 7 |
| Staff sergeants | 2 | 2 |
| Other N. C. O.'s | 8 | 12 |
| Farriers | 1 | 1 |
| Shoeing-smiths | 1 | 1 |
| Trumpeters | 2 | 2 |
| Range-finders | 2 | 2 |
| Spare | 3 | 4 |
| | <hr/> | <hr/> |
| | 25 | 31 |
| <i>Draught—</i> | | |
| Guns | 16 | 24 |
| Wagons { | Ammunition | 24 |
| | Forge | 6 |
| | Store | 4 |
| | Ammunition and store .. | 12 |
| Spare | 6 | 8 |
| | <hr/> | <hr/> |
| Total horses | 85 | 109 |

For the sake of comparison I may state that—

| | Men. | Horses. |
|--|------|---------|
| The war strength of a R.H.A. battery is | 182 | 183 |
| The war strength of a 9-pr. or 13-pr. F.B. is | 175 | 132 |
| The war strength of a machine-gun battery of six guns | 120 | 109 |

The amount of ammunition carried per gun with the battery would be :—

| | Rounds per gun. |
|------------------------------------|-----------------|
| In the axletree boxes | 1,000 |
| In the gun-limber box | 3,000 |
| In the wagon-limber and body | 7,000 |
| Total..... | 11,000 |

These numbers are calculated from the amount of room the cartridge-holders for the Gardner gun take up.

The supply of ammunition would be kept up in the field by S.A.A. carts from the ammunition column, each carrying nearly 10,000 rounds in the service S.A.A. boxes.

The empty holders would be refilled from those boxes by the spare gunners while the battery was in action.

The front of this battery in action would be calculated at 15 yards interval between each gun.

If the number of men and horses in the above estimate be thought too extravagant it could be reduced by substituting for the wagons, six two-wheeled carts similar to S.A.A. carts, but fitted to carry 7,000 rounds of ammunition in holders. This arrangement would effect a saving of six drivers and twelve horses, but on the other hand the carts would not possess the mobility of the wagons nor could the spare gunners be mounted on them, and the efficiency of the battery would thereby be impaired to a certain extent.

Lord Charles Beresford has recommended a carriage for machine-guns which will enable the gunners sitting on the trail to keep up a fire in the act of retiring. This I do not think feasible, for these reasons: in the first place it seems to me that the difficulty of feeding the gun when in motion would be insurmountable; and secondly, the motion of the gun going over any but the most level ground would cause the bullets to fly anywhere but in the required direction. If the gun were in danger of being captured while in the act of retiring, it could be better defended by the carbines or revolvers of the detachment than by its own fire, wild and uncertain as it would be under the circumstances. Again, when firing limbered up at the halt the least motion of the horses would throw the trail out, while the time saved by not having to limber up before retiring would be inappreciable. Moreover, by remaining limbered up when in action the limber and horses would be very much exposed and would increase the size of the mark for the enemy's fire to a very great extent.

The only point to be decided on in forming such a battery is the

nature of the machine-gun to use ; that question I will not discuss at present beyond saying that if the accounts that have reached me of the performance of the new Maxim gun are correct, there is very little doubt but that this will be the machine-gun of the future. The gun being so light (only 60 lbs.), two of them might be mounted on the same carriage and worked together by the same elevating and traversing arrangement, in fact becoming to all intents and purposes a two-barrelled Maxim gun.

A machine-gun battery, such as I have endeavoured to describe above, could be used in numberless ways in a campaign, and I think it would be especially useful in accompanying cavalry in order to drive away any bodies of infantry before which the cavalry would otherwise have to fall back. When it could get within 1,700 yards of the enemy's artillery it would speedily put a battery out of action before sustaining serious damage itself, while in defending a position against an infantry attack it would be invaluable, combining by its mobility great powers for counter-attack as well as for passive defence.

It is sincerely to be hoped we shall not be behindhand in giving the latest machine-guns a fair trial, equipped in a way suited to their tactical powers, and that it be done in time of peace, so that if war should break out, batteries of machine-guns would be ready for service completely efficient both in their equipment and in the training of the men and horses.

Mhow, Central India,
June 10th, 1885.

Friday, January 15, 1886.

COLONEL G. H. MONCRIEFF, Commanding Scots Guards, in the
Chair.

THE TRANSMISSION OF DRAWINGS BY SIGNAL.

By ALEXR. GLEN, Lieutenant 14th Middlesex (Inns of Court) R.V.

IN this paper I propose to explain a system which I devised and have elaborated in conjunction with my brother Officer, Mr. Willink, and with the assistance of the signallers of our corps, the Inns of Court Volunteers. The object of the system is that one person who has the means of communicating with another by telegraph, heliograph, lamp, flag, or other mode of signalling, may enable the recipient of the signals to make a facsimile of any drawing which may be in the hands of the sender. The drawing may be of any kind, from a rough sketch or plan to a photographic likeness or a chromolithograph. The accuracy with which the drawing is transmitted may be increased to any extent that the sender may think fit; while the scale on which the facsimile is drawn is at the discretion of the recipient.

The important question, however, is the practical application and utility of the system. On this question, as a volunteer, I can only offer a few crude suggestions, and leave it to be discussed, as I hope it will be, by those who have experience of the requirements of the Service.

When I was attending the School of Instruction in Army Signalling at Wellington Barracks in 1883, the District Signal Officer, Lieutenant-Colonel Bonham, remarked that army signalling was in its infancy, and comparatively undeveloped, and that he thought that it was a subject in which volunteers had the opportunity of doing service to the Regular Army. It is, I think, to a great extent a result of that remark that I have this paper to read to-day.

The idea of transmitting a drawing by the methods of army signalling originated in my case in a little scheme that I carried out on the march to Portsmouth for the Easter Review of 1884. On the Good Friday morning there were to be some small manœuvres in connection with the pursuit of a convoy that was to start southwards from Petersfield. I was in charge of the Inns of Court signallers, and leaving Petersfield at an early hour with one signalling party, we took up a station on Butzer Hill, with the object of signalling the movements of the convoy to the other party, whom I had stationed at Petersfield. With the Petersfield party I had left a number of small tracings from the ordnance map of the neighbourhood, with instructions to mark the points referred to in any message received from me

on one of the tracings, and to pin the tracing to the message form. This was carried out, but I soon found difficulty in expressing shortly, and at the same time accurately, the exact positions of the convoy and its escort, with reference to the Ordnance map which I had with me. It occurred to several of us independently that the simplest way of overcoming this difficulty would be to draw vertical and horizontal lines in corresponding positions on the map and the tracings, and to letter the spaces between them.

The positions of the shot marks on the targets in an Anglo-American rifle match shot at Wimbledon had previously been transmitted by cable across the Atlantic in a somewhat similar manner, except that, I believe, short words were used to indicate the different spaces into which the diagrams of the targets were divided, instead of merely letters.

From signalling single points to be marked on an existing map or copy it was but a short and almost obvious step to dispense with copies of the original map, and to transmit the position of roads, fences, houses, and the like in addition to other information. It is only, however, after innumerable experiments and practical trials, during the latter part of 1884 and the beginning of 1885, that a series of rules has been formulated, by which not only military sketches but recognizable likenesses have been signalled. Before I conclude this paper I will refer to some of the drawings to which the system has been applied.

I must mention that on submitting a copy of the rules in their then condition to the War Office, through Colonel Moncrieff, who kindly interested himself in them, I ascertained for the first time that Lieutenant-Colonel Melville, R.E., had already submitted an apparatus, which I subsequently learned he had patented in April last, to be used for the purpose of transmitting drawings or marks on a drawing by signal.

The following are the terms of his specification :—

“It is often convenient to be able to communicate by telegraph or telephone, or generally by signal, from a distance, information as to localities and positions when there are no means of transmitting plans. My invention relates to a method and apparatus for producing, according to signal, copies of plans or other marks, the like method and apparatus being also applicable for communicating by cypher.

“For this purpose I provide, at each of the two stations which have to communicate, a board or frame which is graduated along the side by distinctive numbers or letters, and which has fitted to it a graduated rule which can be slid, guided parallel to itself, along the board or frame. Assuming that a plan or sketch existing at the one station has to be reproduced at the other, the sending operator slides his rule along the plan to some point thereon and signals the two numbers, letters, or marks which indicate that position, the one number, letter, or mark signifying the position of the rule, and the other the position of the point relatively to the rule, in other words, they indicate the co-ordinates of the point. The receiving operator moves his rule and marks a point according to the signal. Thus by

Fig. I.

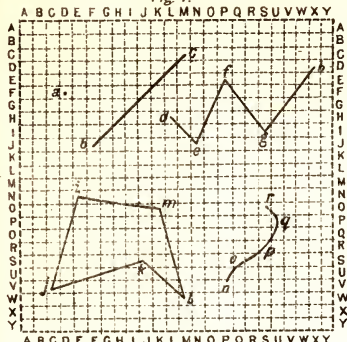


Fig. II.

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| ZAA | ZBA | ZCA | ZDA | AZA | BZA | CZA | DZA |
| ZAB | ZBB | ZCB | | AZB | BZB | CZB | |
| ZAC | ZBC | ZCC | | AZC | BZC | CZC | |
| ZAD | | | | AZD | | | |

Fig. III.

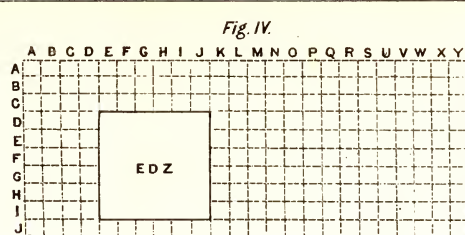


Fig. IV.

| | | | | |
|---|---|---|---|---|
| I | J | K | L | M |
| Y | A | B | C | N |
| X | H | Z | D | O |
| W | G | F | E | P |
| V | U | S | R | Q |

Fig. V.

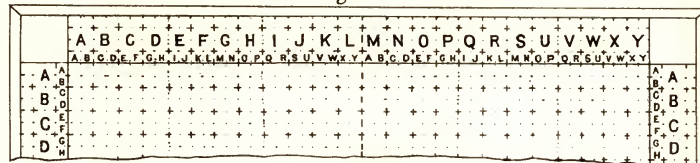


Fig. VI.

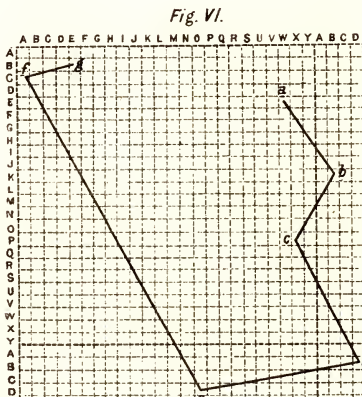
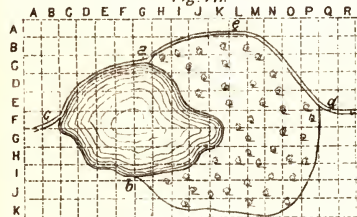


Fig. VIII.

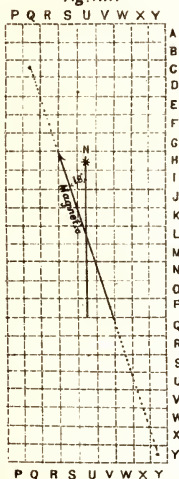


Fig. IX.

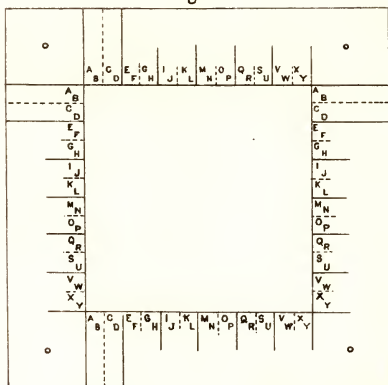


Fig. X.

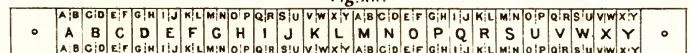
Numbers Niles. Yards.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | — | O | — | Z | — | O | — | Z |
| 1 | — | P | — | Z | — | P | — | Z |
| 2 | — | Q | — | Z | — | Q | — | Z |
| 3 | — | R | — | Z | — | R | — | Z |
| 4 | — | S | — | Z | — | S | — | Z |
| 5 | — | U | — | Z | — | U | — | Z |
| 6 | — | V | — | Z | — | V | — | Z |
| 7 | — | W | — | Z | — | W | — | Z |
| 8 | — | X | — | Z | — | X | — | Z |
| 9 | — | Y | — | Z | — | Y | — | Z |

Fig. X.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J |
| A | | | | | | | | | |
| B | | | | | | | | | |
| C | | | | | | | | | |
| D | | | | | | | | | |
| E | | | | | | | | | |
| F | | | | | | | | | |
| G | | | | | | | | | |
| H | | | | | | | | | |
| I | | | | | | | | | |
| J | | | | | | | | | |

Fig. XI.



NOTE.

Fig. IX.—Angular measurements may be represented in like manner with the help of the letter T, that letter being placed before the first digit in order to represent the number of degrees in an angle measured (from the magnetic north eastwards, unless otherwise stated), in a horizontal plane, and being placed after the last digit to represent an angle measured (from a horizontal line upwards), in a vertical plane. The "T" may be doubled for the purpose of indicating that the angle is measured to the west (in a horizontal plane), or downwards (in a vertical plane). Thus "TQWO" or "TTYO" would denote "due west," and "RUUT" or "UUT" would denote "sloping 5° downwards."

Fig. XI.—The small letters and the dots in this figure should be in red.

Fig. XII.—The small letters should be in red.

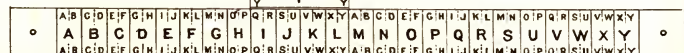


Fig. 1.

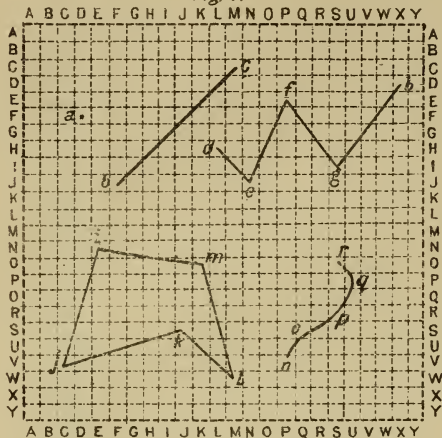


Fig. VII.

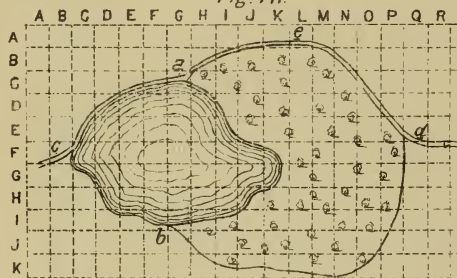


Fig. VIII.

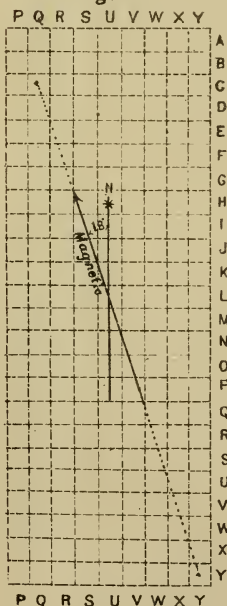


Fig. 11.

| | | |
|-----|-----|-----|
| ZAA | ZBA | ZCA |
| ZAB | ZBB | ZCB |
| ZAC | ZBC | ZCC |
| ZAD | | |

Fig V.

| | | | |
|--|---|---|---|
| | K | L | M |
| | B | C | N |
| | Z | D | O |
| | F | E | P |
| | S | R | Q |

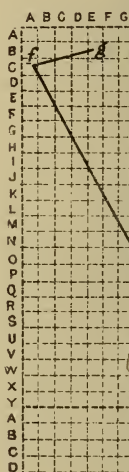
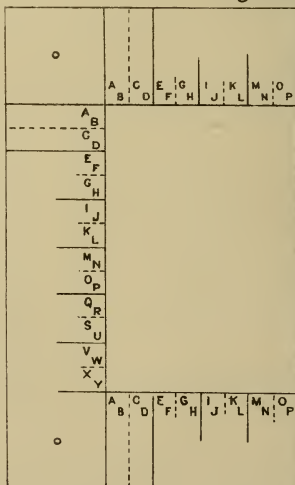


Fig. XIII.

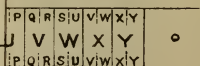


TE.

measurements may be
anner with the help of
er being placed before
o represent the number
e measured (from the
ards, unless otherwise
plane, and being placed
to represent an angle
zontal line upwards), in
e "T" may be doubled
dicating that the angle
t (in a horizontal plane),
vertical plane). Thus
TY O" would denote
R U UT" or "UUT"
5° downwards.

all letters and the dots
e in red,

all letters should be in



signalling the co-ordinates of a number of points on the plan at the sending station and the character of the localities with which those points correspond, the sender enables the receiving operator to determine corresponding points, and to sketch a plan corresponding to the original.

"In like manner, other designs or marks could be reproduced according to signal, and cyphers might also be communicated in several ways. For example, a message might be sent as a sketch or drawing with a number of its points marked by the sender according to letters or marks reckoned from some predetermined origin of co-ordinates, and the receiver, subjecting this sketch to his frame, would be able to read the same letters as those by which the points were determined on the sketch, and could thus decypher the message.

"Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is—

"1. The herein described method of producing copies by signal, that is to say, by signalling co-ordinates of points from one station, and marking these points at another.

"2. For producing copies by signal or communicating by cypher, the use, at each of two communicating stations, of apparatus consisting of a board or frame graduated along its side and a graduated sliding rule adapted thereto, substantially as herein described."

I understand that Lieutenant-Colonel Melville has formulated instructions and suggestions for the use of his apparatus; and I hope that he will give the Institution the benefit of his views on the subject of this paper.¹ His specification, instructions, and apparatus, and our system, which has since been considerably amended and improved, have both, I believe, been tried and reported upon at Aldershot, and I understand that they were afterwards sent to the Staff College.

No apparatus beyond paper and pencil, and some strips cut from the paper and marked in the manner hereinafter to be described, is absolutely necessary for converting the drawing into a message capable of being signalled, or for reproducing the drawing from the message, by our system; but for convenience, and in order to save time, we use sectional paper, that is, paper with faint equidistant lines ruled upon it vertically and horizontally, and certain instruments which will also be described presently.

A plan might possibly be signalled in the course of time by merely giving the co-ordinates of points in connection with explanatory sentences, but the message would be of such inordinate length as to be practically useless. In order to bring the message within a reasonable compass, we have by degrees settled a number of rules, which I will now proceed to explain with the help of the diagrams.

Columns and Rows.—The drawing is divided by actual or imaginary lines into columns of a certain breadth, and into rows of the same

¹ For further particulars, see pages 90—91.—Ed.

breadth, at right angles to the columns. First, suppose the drawing to be square and to be divided into twenty-four columns and the same number of rows, and the columns to be marked as in Fig. 1 with the letters of the alphabet (omitting T and Z) from left to right, and the rows to be marked in like manner from top to bottom.

Points.—Any point on the drawing may then be denoted with a degree of accuracy depending on the breadth of the columns and rows, by a group or pair of letters, namely, the letter marked on the column in which it appears, followed by the letter marked on the row. Thus in Fig. 1 the point *a* is denoted by the group "DF."

Straight Lines.—A straight line joining two points is denoted by joining in one group the two pairs of letters which denote those points. In Fig. 1 the straight line *bc* is denoted by the group "FJMC."

Bent Lines.—A line passing through a series of points, such as the line *defg* in Fig. 1, is denoted by the series of groups which denote those points; and in order to distinguish the line from a number of detached points, the letter T is used. It will be remembered that this letter is one of those which are omitted from the alphabets placed round the square. It is placed at the beginning of the first group of the series and at the end of the last. Thus the line *defg* is denoted by the series "TLH, NJ, PE, SI, XDT."

Enclosed Spaces.—It is important to save letters and shorten the message when possible, and if the line eventually reaches the point from which it started, so as to enclose a space, the pair of letters denoting that point may be omitted from the last group of the series, leaving the letter T standing alone. The figure *ijklm* may therefore be denoted by the series "TEN, CV, JS, MW, KO, T," the single T being used instead of "ENT."

Curved Lines.—A curved line is denoted by indicating as many points in it as the degree of accuracy required may demand. For instance, the series "TPV, QS, SR, UP, SOT" denotes the curve *nopqr* sufficiently closely for the purposes of a sketch.

Degrees of Accuracy.—The accuracy of a drawing reproduced from the signalled messages, as compared with the original, depends on the breadth of the columns and rows. For a rough sketch, or for the less clearly defined features of a map, the breadth may be a $\frac{1}{4}$ inch. Generally $\frac{1}{8}$ inch will give sufficient accuracy, but if great accuracy be required the breadth should not exceed $\frac{1}{16}$ inch, while for photographs I have used columns and rows of $\frac{1}{32}$ inch in breadth. For one part of the drawing columns and rows of one breadth may be used, and for another part columns and rows of another breadth, the proper prefix being inserted in the message when the change is made.

Prefixes for First Degree of Accuracy.—With regard to these prefixes (which form an essential feature of the system which I am describing), when $\frac{1}{4}$ -inch columns and rows are used, and the drawing is larger than a 6-inch square, it is divided into as many 6-inch squares as may be necessary. Each of such squares will have its own prefix. At the commencement of the message, or on changing the degree of accuracy, or in certain cases when the drawing is very large, and the short prefixes to be mentioned presently do not suffice, the

prefix will consist of three letters, of which the first is Z, the second of the letters omitted from the alphabets placed round the squares. The other two letters of the prefix are determined according to the rule already given for denoting a point. Thus in Fig. 2,—

| | |
|--|------------------------------------|
| The prefix for the square at the upper left corner is ZAA. | |
| “ | “ next on the right of ZAA is ZBA. |
| “ | “ “ “ “ ZBA „ ZCA. |
| “ | “ next below ZAA „ ZAB. |
| “ | “ “ “ “ ZBA „ ZBB. |
| “ | “ “ “ “ ZAB „ ZAC. |

And in like manner any other square may be noted. If the drawing be not larger than a 6-inch square, the prefix ZAA will be given.

Prefixes for Second Degree of Accuracy.—When $\frac{1}{8}$ -inch columns and rows are used the drawing is divided into 3-inch squares, and the prefix for each is the same as if it were a 6-inch square, except that the letter Z is now in the second place instead of the first. Thus in Fig. 3,—

| | |
|--|------------------------------------|
| The prefix for the square at the upper left corner is AZA. | |
| “ | “ next on the right of AZA is BZA. |
| “ | “ next below AZA „ AZB, |

and so on.

Prefixes for Third Degree of Accuracy.—When $\frac{1}{16}$ -inch columns and rows are used, the Z is put in the third place; but it would be inconvenient to divide the whole map into $1\frac{1}{2}$ -inch squares, and this degree of accuracy is usually required here and there only, as for instance, in order to give the positions of the houses in a village which occupies but a small portion of the map. The two other letters of the prefix, therefore, refer to a column and a row belonging to a 6-inch square, and the $1\frac{1}{2}$ -inch square is taken in such a position that its left side coincides with the left side of that column, and its top with the top of that row. The prefix for the $1\frac{1}{2}$ -inch square shown in Fig. 4 is “EDZ,” the proper prefix of the 6-inch square in which it is placed being given immediately before it, unless the message had been dealing with that 6-inch square, when $\frac{1}{4}$ -inch or $\frac{1}{8}$ -inch columns and rows were last used.

Short Prefixes.—It will not be necessary to give a full prefix of three letters when passing, without changing the degree of accuracy, from one square to a point in any of the eight squares which surround it, or in any of the sixteen squares which surround the eight. A single letter may be used to indicate a change from any one of these twenty-five squares to any other. The central square from which the first change is made is indicated by the letter Z; the eight squares surrounding it by the letters A to H, commencing with the square at the upper left corner of the central square, and going round it in the same direction as the hands of a watch; the remaining letters of the alphabet (omitting T) indicate the sixteen outside squares in like manner. The twenty-five squares in Fig. 5 are lettered in this way. In making the change from square to square

in the course of a message, the letter indicating the new square is always placed at the commencement of the first group, which denotes a point or line or a part of a line in such new square, except in the case of the letter Z, which must stand alone, in order that the group may not be mistaken for the full prefix of a 6-inch square. The succeeding groups of the message will have reference to the new square, unless and until a fresh change of square is indicated either in like manner, or by a fresh full prefix, or by the letter T standing alone and showing that a line which is being given returns to its starting point in some other square. The letters indicating the change of square will always have reference to the same central square until a fresh full prefix is given. An example of these changes is shown in Fig. 6, in which the line *abcdefg*, starting from *a*, is denoted by the series of groups "TWE, DBK, Z, XP, EDB, FOD, Z, AC, EBT."

By means of these long and short prefixes, the message may be made to travel over a drawing of considerable size without diminishing the accuracy with which each point is given.

Brevity of Message.—Accuracy is no doubt the most essential requirement in a system of signalling drawings. Brevity is the next. Attention has been given to this second requirement in the foregoing rules, but in order to obviate the necessity for inserting explanatory or descriptive sentences in the message, some further rules have been made.

Descriptive Words.—In the message words descriptive of the features of the drawing will apply to all groups which follow them, until fresh descriptive words are given which modify or supersede them. The repetition of descriptive words or sets of words may be avoided by denoting them by single letters (other than T or Z), the letter denoting the descriptive word or set of words being given by itself next after the word or set of words is given for the first time, and then in subsequent parts of the message being given alone without description. Or a code of descriptive expressions likely to be used might be arranged beforehand between the sender and receiver of the message.

Degrees of Light and Shade.—To indicate spaces covered with different degrees of light and shade, as in a photographic likeness, as many of the first letters of the alphabet may be used in place of descriptive words as there are degrees to be indicated, A indicating the absence of shade, B the lightest shade used, C a darker shade, and so on. For the shades of a photograph, it will be sufficient to use six letters, A to F. If the drawing be in several colours, the same letter will be used to indicate the corresponding shade of each colour that is mentioned.

Outlines.—Where an outline follows from one point to another a line already given in the message, a considerable saving is effected by omitting the groups denoting the intermediate points, and placing the letter T at the commencement of the group denoting the second of the two points. If more than one line between those points has been given, so that the omission of all the intermediate groups would create an ambiguity, then one or more of the intermediate points, preceded

if necessary by the letter T in like manner, must be given to indicate the course of the outline. For instance, if the wood shown in Fig. 7 has been given first, then in messaging the outline of the lake, after giving the point *a*, denoted (say) by the group "GC," it will not be necessary to indicate any points round the right hand side of the lake, but the next group after "GC" may be "TFI," the pair of letters "FI" denoting the point *b*; or if the outline of the lake had started from the point *b*, and passed through *c* to *a*, then the group "TT" would show that the outline returned to the starting point *b* along the edge of the wood, and not in a straight line from *a* to *b*. But in messaging the road subsequently to the wood and the lake, after giving "BF" for the point *c*, it will not be sufficient to give "TQF" for the point *d*, or it will be uncertain whether the road runs above or below the wood and lake. If a point such as *a*, denoted by the group "LA," be given, the two groups "TLA, TQF" will show that the road passes along the upper edges of the lake and the wood.

Size of the Drawing.—The size of the paper which the receiver of the message will require may be indicated by giving the full prefix of the square (6-inch, 3-inch, or $1\frac{1}{2}$ -inch) whose lower right hand corner is at the lower right hand corner of the drawing. If the message is not commenced in that square, a second full or short prefix will have to be given.

Scale.—The scale of a map or plan may be given by stating at the commencement of the message, after the first prefix, the distance represented by an inch; and if this distance be given in miles, or as a fraction of a mile, it will be sufficient to give the number of the miles, or the fraction. For instance, in the case of a plan drawn on a scale of 40 feet to the inch, the words "forty feet" will give the scale; in the case of a map drawn on a scale of 20 miles to the inch, the word "twenty" will suffice; or if the scale be 6 inches to the mile, the word "sixth."

Points of the Compass.—Maps may be assumed, unless the contrary is indicated, to be drawn so that lines running upwards, parallel to the columns into which they are divided, represent the direction of the magnetic north. Where a map is not drawn in this manner, the direction of the magnetic north should be given immediately after the scale by a group or groups denoting a line drawn in that direction. If the direction of the true north instead of the magnetic be given, the word "true" must be added. If the columns run in the direction of the true north, it will be seen from Fig. 8 that the group "YYQC" indicates the direction of the magnetic north for this country, 18° west.

Direction of Motion.—The direction in which streams, troops, &c., are moving is indicated by the order in which points along that direction are given.

Numbers and Distances.—In an ordinary message, all numbers are required to be spelled out at length, in order to avoid mistakes; but inasmuch as the messages with which we are now dealing must be transmitted as cypher messages, a code may be used for numbers and distances, without introducing any greater risk of error than there is

in the other parts of the message. The letters O to Y (excluding T) may be taken to denote the ten digits, 0 to 9, but each digit must be sent as a separate word. The number which is given may be made to represent miles by putting the letter Z before, and in the same group with the first digit, or to represent yards by putting that letter after the last digit. The table in Fig. 9 gives these codes. Twenty-five miles will thus be denoted by the two groups, "ZQ, U," 1,500 yards by "P, U, O, OZ." If the sender wishes to indicate that the distances are only estimated, the letter Z may be doubled. Thus "ZZR" would mean "about three miles."

Writing the Message.—To facilitate the correction of errors, ten groups should be put in each line of the message written out from the drawing, and also in each line of the message taken down at the receiving station; and it will be convenient to use for message-forms pieces of paper, such as $\frac{5}{8}$ -inch sectional paper, ruled with spaces for ten lines on each piece, and ten groups in each line, besides a margin for the date and other notes. The pages of the message, the lines on a page, and the groups in a line, may then be referred to by consecutive letters; A for the first page, for the first line on each page, and for the first group in each line; B for the second, and so on; so that any group in the message may be referred to by a group of three letters. The seventh group in the fourth line of the second page of the message would thus be denoted by the group "BDG," as in Fig. 10.

Collation of the Message.—In signalling the message it is essential that all groups, other than descriptive words, should be carefully collated, that is to say, that the receiving station should signal back each group as it is taken down at that station, in order that in the event of a mistake having been made, the group may be erased and signalled again. To indicate that a message represents a drawing, and is therefore to be collated in this manner, the preparative signal "CCC" may be given instead of the "CC" that indicates other cypher messages.

Correction of the Message.—If the message exceeds one hundred groups in length, the number of groups on each page should, if incorrect, be corrected before proceeding with the next page. With this object the sending station will give a succession of dashes at the end of the page: and at the end of the message, if this is not also the end of a page, will give a succession of dashes, followed by the three letters that denote the page, line, and group of the last group of the message. If the receiving station finds that it has the proper number of groups, it will give the general answer; if not, it will give "G." When the sending station thus finds that the wrong number of groups has been taken down at the other station, it will first give the initial letter of each line on the page, to be answered by the general answer where taken down correctly; otherwise by a second "G." This second "G" will show in which line a mistake has occurred, and the sending station will therefore go back to that line, and give the initials of each group of the line after the first, until a third "G" is given to indicate the exact place at which the mistake occurred. After this mistake has been corrected the initials of the

lines will be proceeded with unless and until "RT," signifying that the number of groups on the page is now right, or another "G" is given.

Verification of the Message.—The drawing may be reproduced as fast as the message comes in, unless it was messaged before the signalling commenced, and the message is signalled with great rapidity. The draughtsman may call first for the repetition, and then for the verification from the original of any parts of the message that he may have reason to think incorrect, by giving the three letters denoting the place of the group that he wishes to verify, preceded by the "IMI" (the ordinary signal for "repeat"), and afterwards giving "VY" (as an abbreviation of verify). Or if he thinks that part of his drawing has got into the wrong square, he may send "PX" (as an abbreviation of "Prefix"), and obtain a repetition of the group which took the message into the square in which the doubtful point is placed; but in this case the group thus repeated must be preceded by the three letters denoting its place in the message.

Reproduction of the Drawing.—The points denoted by the letters of the message will always be marked by the draughtsman in the centres of the proper columns and rows, in order that the maximum error due to the degree of accuracy that is being used may nowhere be exceeded. He should not round off the angles formed by the lines denoted by the message as he reproduces it, nor should he then attempt to blend together different degrees of light and shade; but this may be done subsequently, or on a tracing or other copy, if one is made, according to the nature of the feature of the drawing delineated.

Apparatus.—I have stated that no apparatus is absolutely necessary beyond paper and pencil, and such apparatus, if it can be so called, as may be readily made out of paper. But we have devised several instruments for our own convenience.

Transparent Square.—In order to read off a drawing into a message rapidly, I prefer to use a transparent square of horn, clamped to the back of a metal frame. The sides of the square are 6 inches in length, and the $\frac{1}{4}$ -inch and $\frac{1}{8}$ -inch columns and rows are scratched on the lower side of the horn, so as to come in contact with the drawing. The front of the frame is lettered in black for the $\frac{1}{4}$ -inch, and in red for the $\frac{1}{8}$ -inch columns and rows; so that when the square is placed upon the drawing the letters denoting any point with the first or second degree of accuracy are seen at once. The corners of the frame fit into the metal corners at the top, or those at the bottom of a small drawing-board in a sketching-case; these metal corners being placed at such a distance apart as to allow two 6-inch squares of the drawing to be messaged without shifting the paper.

A less durable form of transparent square consists of a square of tracing cloth, lettered and marked in the same manner as the frame and the horn. Sectional tracing cloth with the lines ruled on it can be procured, or a piece of sectional paper may be marked, and a tracing taken from it. In the latter case it is well to mark the columns and rows with small crosses in black, and spots in red, as in

Fig. 11; because if lines are drawn on the transparent square, they sometimes obscure lines on the drawing.

For messaging photographs we have used a transparent square of glass, with lines ruled on the lower surface with a diamond, and with the letters marked on paper gummed to the upper surface. This was in order to get columns and rows of $\frac{1}{32}$ -inch in breadth.

Colonel Melville's Frame.—Instead of a prepared transparent square, the table or frame and sliding bar patented by Lieutenant-Colonel Melville may be used, if it is lettered in the manner above described, the sliding-bar being moved along from point to point as required.

Strips.—If a prepared transparent square, or a frame and sliding-bar, should not be available for converting the drawing into a message, strips of sectional paper ($\frac{1}{8}$ -inch scale) may be lettered for the $\frac{1}{4}$ -inch and $\frac{1}{8}$ -inch columns and rows in a few minutes, as in Fig. 12.

We have had permanent strips made of white metal in the pattern shown in Fig. 13. If one of these strips, lettered from left to right, be pinned at the top and another at the bottom of a 6-inch square, the letters denoting any point may be found with the help of the third strip, which is lettered from top to bottom, and placed between and at right angles to the others, as in Fig. 13. If the drawing be upon sectional paper, the lower strip may be dispensed with, and the vertical strip pinned at the side of the 6-inch square.

If sectional paper be not available, a strip may be prepared by folding a piece of plain paper, so as to get a straight edge, and then marking off from a protractor or other scale, and lettering spaces of a $\frac{1}{4}$ inch and $\frac{1}{8}$ inch. If a protractor or scale be not available, a space of $\frac{1}{4}$ inch may be marked, as nearly as may be, on the edge of another piece of paper, and this may be used as a measure for marking off equal spaces on the strip. These spaces can then be subdivided by the eye with sufficient accuracy into spaces of about $\frac{1}{8}$ inch. The scale on which the drawing is made will then be communicated to the receiver by giving the distance between some two objects appearing on the drawing.

For reproducing the drawing from the message, the lettered strips are used in the same manner as above described; and much time will be saved by drawing upon sectional paper.

Hollow Square.—The transparent square and the strips above described are not lettered for the third degree of accuracy, which requires columns and rows of $\frac{1}{16}$ inch, because the $1\frac{1}{2}$ -inch square divided into columns and rows of that breadth has to be placed here and there on the drawing as it happens to be required. For this degree of accuracy a flat piece of metal, wood, card, or paper, with a $1\frac{1}{2}$ -inch square cut out of it, is used. It is only marked with $\frac{1}{8}$ -inch spaces, because the position of imaginary lines dividing the $\frac{1}{8}$ -inch columns and rows into columns and rows of $\frac{1}{16}$ inch can be accurately judged by the eye. The letters are marked round the edge of the square in the pattern shown in Fig. 14, two letters being marked in each space. The mode of fixing the position of the $1\frac{1}{2}$ -inch square with reference to a 6-inch square has been already described. A hollow

square may be readily made from a piece of the sectional paper; but if sectional paper be not available, small strips must be prepared from plain paper, and used in the same manner as the larger strips.

That is our system as it at present stands. Our difficulty has been not only to construct a message which should accurately represent a drawing, but to enable the receiver of the message to ascertain quickly the exact places where errors, which are no doubt to some extent inevitable, have crept in, in order that he may at once call for corrections, and if necessary for the verification of the message, where he finds that something is wrong, without causing unnecessary repetition and delay. Improvements in this respect, and other rules tending to expedite the process and increase its accuracy will doubtless be devised from time to time, if the system be adopted for practical purposes; indeed we have been amending and making additions to the rules up to the time of the final revision of this paper; but the system as I have described it is capable of transmitting a map or sketch in a comparatively short space of time with as much accuracy as I take to be necessary for military purposes, if a reasonable amount of care be taken in making the message, signalling it, and working out the drawing.

For instance, we took the plan of the battle of Hasheen, which appeared in the "Standard" of the 8th April last, and signalled it by flag across Wimbledon Common. The copy which was reproduced by the recipients of the message seems as useful for all practical purposes as the original. The suggestion arising from this is that similar plans might be telegraphed with despatches for the purpose of explaining them graphically.

Again, we have transmitted in like manner the plan of a village prepared for defence, which is given at p. 197 of Colonel Brackenbury's "Minor Tactics." Colonel Moncrieff saw us signal by flag and reproduce about one-sixth of this plan in twenty minutes at our camp of instruction last summer. This suggests the possibility of transmitting by heliograph to a long distance an accurate plan of fortifications, or the preparation made for the defence of a position over the heads of an investing force. And it should be observed that if the cypher wheel, or any preconcerted arrangement of the letters of the alphabet were used, the plan could not be reproduced without the key to the cypher.

On another occasion, a surveying party went to Uxbridge early one afternoon, and made a plan of the railway station and traverses of the roads. The road traverses were taken to a signal station on Uxbridge Common, and when put together formed a plan representing an area of about a mile and a half by a mile, showing about three miles of main road with the adjacent houses, fences, and other details. The plans were messaged during the afternoon, and had the weather permitted, I believe that the whole instead of merely the plan of the station would have been heliographed to Harrow, 6 miles distant, during the afternoon; for we went to the same stations on two subsequent occasions, and eventually got the message through, chiefly with the flag, noting the time occupied. I found that the plan could be reproduced

as the message was received, so that the copy was finished within a few minutes after the signalling ceased. A tracing taken from the copy and placed over the original shows that the maximum error due to the degree of accuracy to which we were working was approached in two or three places only. I suggest that there may be occasions on which it would be advantageous to signal back a road survey and report in this manner.

Another experiment in conducting the several operations of the process as far as possible at the same time was made with the view given in Plate V of Colonel Richard's "Text Book of Military Topography." One of us sketched, and then converted into a message, a small portion of the view, and while that was being signalled sketched and messaged another small portion, and so on. This of course caused delay in the completion of the original sketch; but the reproduction easily kept pace with it, and the result appears satisfactory. The delay may be lessened by the draughtsman calling out the message as he draws to a second person to be written down, or by making the sketch upon paper ruled with more distinct lines than those on the sectional paper, so that a second person may look over his shoulder, and write out the message without interrupting the drawing. For this purpose we have used a square of tracing cloth with the lines ruled on the lower surface, and with the upper surface so prepared that pencil marks may be rubbed out when the message is completed, and the cloth may be used over again. The advantage which proceeds from conducting the several operations at the same time is that each portion of a sketch that is being made by an Officer sent out to reconnoitre, may be reproduced at the receiving station within a few moments after it is first sketched from nature, and that in the event of the reconnoitring party being cut off, or the original drawing from any cause not being safely brought back, the facsimile of as much or almost as much as has been drawn will be available for use.

One more suggestion I wish to make as to the possible utility of signalling plans in the field. It may, perhaps, prove useful in keeping communication continually open between the various moving parts of a division or divisions before and during an engagement, as well as useful in transmitting information when communication is open. My means of knowledge on this matter are of course extremely limited, my experience being limited to the Easter volunteer manœuvres, at the last two of which I have had charge of our signallers; but on those occasions I was able to appreciate the difficulty, of which I had previously heard, of keeping up communication between moving stations. At Portsmouth in 1884 a message was brought to our station to be signalled to a brigade which was in sight, but we did not know where the signal party attached to that brigade was. We failed to open direct communication with it, and some time elapsed before we found a station behind us through which the message was eventually sent round. On Easter Monday last year at Brighton, each of the signalling parties under Major Roberts (London Irish R.V.), attached to one division, by a preconcerted arrangement ascertained from the others, on taking up its position, to

which of the other stations in sight a message addressed to a particular brigade would have to be sent. On this occasion there was comparatively little movement of the signalling stations during the sham fight, and a considerable number of messages were sent through; but I think that a good deal of movement might have taken place without the different parties losing the touch that they had obtained in the few minutes before the sham fight commenced. Now I suggest that if each station were, by the system that I have described, to transmit to one central station its own position on an existing map, or if no maps were available its position with reference to conspicuous objects and features of the ground, a plan of the whole ground, showing each station, might quickly be marked or roughly made at the central station, and sent out to each station as opportunity arose. On a material alteration of the position of any station taking place, a few letters sent through would be sufficient to enable the necessary alteration to be made in the plan at each station. The movements of troops, with the times at which the movements took place, might be recorded at each station in like manner; and the plans, with their latest alterations, would, I presume, be useful to the General in command and to others under him. The Officer in command of the signallers would, moreover, have his whole command practically under his eye; he would see where fresh stations were required, and would be able to direct the movements of his signalling parties very quickly.

We have tried the system upon photographs and other likenesses, not because we at present see any practical utility in this application of it, except possibly for the apprehension of absconding criminals, but rather with a view of proving in an obvious and unmistakable manner the remarkable accuracy with which a drawing may be signalled by means of the system. For instance, the engraving of our late Colonel, J. R. Bulwer, Esq., Q.C., M.P., which appeared in "Pump Court" of October last, was put into a message; columns and rows of $\frac{1}{3\frac{1}{2}}$ inch in breadth being used for the purpose. The likeness was reproduced on a larger scale, and it was not until it was approaching completion that the draughtsman perceived whom it represented. After it was finished, however, it was recognized by everyone acquainted with Colonel Bulwer who saw it.

The system which I have described is based upon the representation of the position of a point by its Cartesian co-ordinates approximately. Polar co-ordinates may be used in almost exactly the same manner, but it will be found that that system gives this peculiar result, namely, that the accuracy with which the position of a point is represented increases as its distance from the pole diminishes. The only case which has occurred to me in which this peculiarity would be advantageous is where the diagrams of a rifle match are to be signalled; for if the centre of the bullseye be taken as the pole, the better the shot the more important its exact position is, and the more accurately this position will be given; and having regard to the fact that the divisions of the target are circular, rectangular co-ordinates are inconvenient.

We attempted to post diagrams in the Union at Oxford showing the

progress of a rifle match shot last summer between our corps and the Oxford University Corps at Hincksey; but partly, I think, in consequence of my being dissuaded from using a system of polar co-ordinates, because we had not practised it, and partly because we had to work a line of three signalling stations as well as prepare the message and reproduce the diagrams with only seven available men, two of whom were themselves shooting in the match, we only succeeded in diagramming (to use a Wimbledon expression) some seventy or eighty shots with many mistakes. We hope, however, to try the experiment with greater success next summer.

I have only to add that the configuration of the surface of a solid object is transmitted when the contour lines on a map are indicated. No doubt the configuration of any solid might be signalled by extending the basis of the system to co-ordinates of three dimensions, but I am not aware that such an extension would be of practical use.

The CHAIRMAN: I am sure that all those of us who have had any experience in signalling must have heard with great astonishment the wonderful results that this system is evidently going to work out. I am happy to say that Colonel Melville, who, quite apart from Mr. Glen, was struck by the same idea of arranging some method of squares and letters in order to fix these co-ordinate points and reproduce a drawing, is here, and I will at once ask him to give us his ideas on this subject.

Colonel MELVILLE, R.E.: Lieutenant Glen having informed you that I have patented a system for signalling co-ordinates for the reproduction of plans, perhaps I may be permitted to tell you what my system is. It is very similar to his; in fact, we have been working on the same lines, though the details are carried out in a different manner. I regret that I have not had many opportunities of trying it. It has been under trial by the Quartermaster-General's Department for some months, but I have not been able to get any specimens of results. I fear I must go over, to some extent, the same ground that Lieutenant Glen has done, because both systems are based entirely on co-ordinates, but my system of sending signals is not by sending groups of letters, but simply by sending the letters giving the co-ordinates of each point. My first idea was to use section paper, but I found when one had got a point in the section paper and endeavoured to follow the lines both ways the eye was apt to get confused, and I therefore thought a sliding scale would be more easy for the purpose.

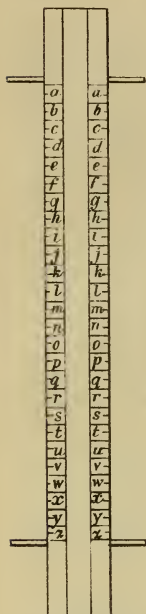
COLONEL MELVILLE'S METHOD OF REPRODUCING PLANS BY SIGNALLING CO-ORDINATES.

THE apparatus is made in two forms, viz., a table or a frame, either of which can be used.

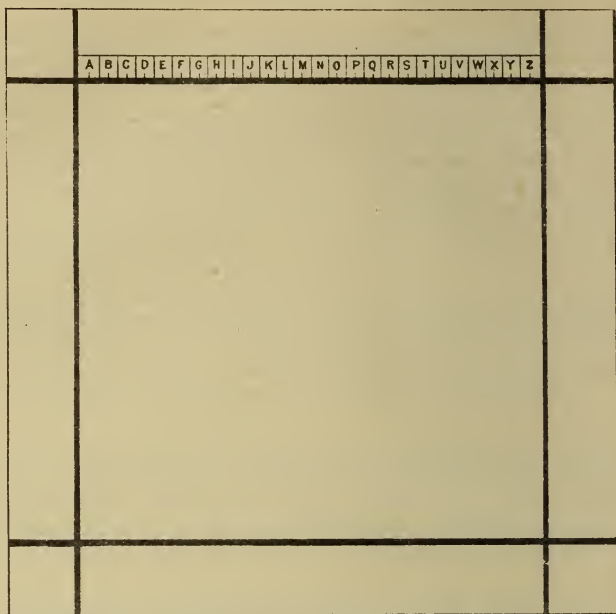
The table has grooves cut in it, in which a rule fixed on runners slides, having room for paper and drawing pins beneath it.

The frame is similar to a square picture frame, and a rule slides over it, being guided by a metal stop at each end; the use of the frame obviates the necessity of the paper being cut to the size of the

COLONEL MELVILLE'S METHOD OF REPRODUCING PLANS BY SIGNALLING CO-ORDINATES.

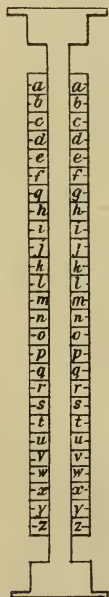


GRADUATED RULE
WITH RUNNERS TO SLIDE
IN GROOVES OF TABLE.

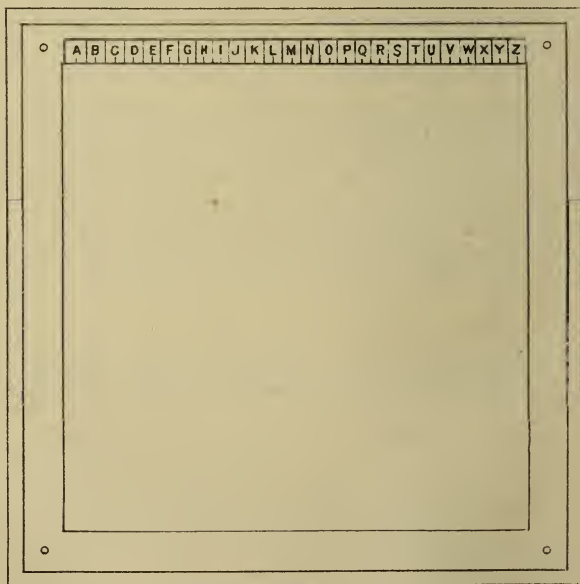


GRADUATED TABLE WITH GROOVES.

SCALE ABOUT $\frac{1}{3}$ RD OF SIZE



GRADUATED
RULE TO SLIDE
OVER THE FRAME.



GRADUATED FRAME.

frame; the latter can be fixed by pins at the corners. The principle of the table and frame is the same. They are graduated along one side by the alphabet in *capital* letters, each letter division being subdivided. Similarly the rule is graduated by the alphabet in *small* letters, and this alphabet on the rule slides on the frame or table at right angles to the *capital* alphabet. Any point can be determined by sliding the rule up to it, first reading the *capital* and then the *small* letter giving its co-ordinates. These letters are signalled, and the point is reproduced in position by the recipient of the signal using his rule and table in a similar way. Any feature in a plan, such as a road, river, &c., is reproduced by the transmission of its salient points in succession.

As each letter is subdivided, it can after a little practice be read to decimals when great accuracy is required, the subdivision representing 0.5. Thus, a point may be described as H_7-s_3 , but a fairly accurate reproduction can be procured without decimals, the same point being read H_s . The eye soon becomes trained to reading decimals, as it does to reading the minutes on the dial of a clock without seeing the divisions.

One need not signal beforehand with what accuracy you are going to send; that depends on the person transmitting it. The fact of the figure being sent after a letter shows that the point is determined with accuracy. Of course there are several abbreviations which may be used, but these would be ascertained by experience. I have not been working at it long enough to find out the abbreviations necessary, but supposing this [diagram] represents a contoured hill which one wanted to transmit, I propose only to signal three parts of it—the apex, the shoulder contour, and the base contour shown in thick lines in sketch, and telegraph on to interpolate the required number of contours between. Of course the distance between the contours would be settled beforehand, that 50 feet or 100 feet intervals were to be represented. It has always struck me that the telephone would be the most useful form of signalling, but there is a difficulty about the similarly sounding letters which I have tried to obviate by using monosyllables. For instance, there are the letters b, c, d, e, g, p, t, v which have very similar sounds; I try to obviate that in the telephonic signal by representing “b” by “bob,” “c” by “cock,” “d,” “deed;” “e,” “eel;” “g,” “gig;” “p,” “pup;” “t,” “tat;” “v,” “valve,” monosyllables repeating the signal letter twice. “M” and “n” are also letters sounding very much alike, therefore I should use “Emma” and “any,” which convey the sound more simply. As regards the scales on which the plans are drawn, they may be made of any size as may be found convenient. The way I should transmit the scale is simply this—supposing we know any portion of a plan was 700 yards long, I should simply say “from D to X 700 yards.” That would be independent of the size of the sheet, and a person having plotted that length would subdivide it into 100 yards and form his scale. As regards these frames, I have submitted them to the War Office, but if they thought of making use of them they could easily be adapted to a sketching case or telephone box, or other

existing article of equipment, so as to save adding to the articles for the men to carry. I think this system would be found very useful from a captive balloon, where you wanted to get an idea of the position of an enemy or what he was doing. You might insert on a plan and transmit the trace of any works he had erected, or the disposition of his troops, or the movements of any particular columns he was working with.

Lieutenant PILKINGTON, 21st Hussars : Since the title of the very instructive and interesting paper which we have heard this afternoon appeared on the notice board of the Institution, I have heard the subject of it condemned and criticized as being rather visionary and rather impractical. It has been said that it is useless, and that its study would only be a waste of that small portion of their precious time which British Officers are willing, as a rule, to devote to the study of their profession. Now, I think everyone who has heard Mr. Glen's paper, and Colonel Melville's description of his own invention, will agree with me that those Officers have certainly not failed to arrive at practical conclusions, and that their time and energy can in no sense be said to have been thrown away. However great be the intrinsic value of Mr. Glen's paper, and much as we have all profited by his very fruitful labours, it appears to me that the greatest value, the most profitable result of his work, lies less in the elucidation of the particular subject which he has studied than in the attention which he has drawn to the possible development of that broader subject which embraces all the means by which information may be collected and transmitted in the theatre of war or on the field of battle. It cannot fail to have struck many, as it has struck me, whenever I have attempted to add to my very limited knowledge of modern war, that the mistakes so often made by even the very greatest commanders are seldom due to ignorance of theory or to error in its application, but in almost every case to some misapprehension of fact, that is to say, to the want of necessary and very often attainable information. If this be so, it is clear that any development of the means by which information may be collected and transmitted will do much to eliminate the very fatal element of chance from the game of warfare. I have no doubt that in the more accurate and extended surveys undertaken on service by Officers of the Staff or the Royal Engineers, such a system as that which Mr. Glen has elaborated will find something more than a limited application. I have, however, taken the liberty of addressing the meeting in order to point out what appears to me the special want which his suggestions, I think, in a great measure supply. I belong to that branch of the Service to which principally appertain the duties of collecting and transmitting information. Now, that in the British cavalry a very large number of non-commissioned officers, in some regiments I think I may say a majority of the non-commissioned officers, and a certain number of private soldiers also are capable of making sketches rapidly and with sufficient accuracy for military purposes, it has often occurred to me that large bodies of cavalry, regiments, brigades, or divisions might, while advancing and performing the duties of reconnaissance and screening, produce very valuable topographical reports. I may say that on a very small scale I have had an opportunity of making experiments in reconnaissances of this kind, but my experiments led to very little ; the results were not satisfactory, the work done occupied, I think, more time than it would have occupied if performed by one person, and the sketches when complete were not very accurate, and in no way satisfactory. However, it appears to me that by the elaboration of some such system, or by a system elaborated from the suggestions which Mr. Glen and Colonel Melville have made, it might become possible for sufficiently accurate sketches to be made in such a manner as I have indicated. My own failure I attribute altogether to my inability to elaborate such a system as is required, and I venture to think that in such work as this, Mr. Glen's suggestions will find eventually their most appropriate application. I feel that some apology is due for occupying the time of the meeting, but if I have succeeded in making a suggestion of any value I am sure I shall be forgiven.

Lieutenant GLEN : I do not think that there is really very much to reply to in

the remarks that have been made either by Colonel Melville or by Mr. Pilkington. It does not appear to me that there is very much difference between my proposals and those of Colonel Melville as far as they respectively go. I have elaborated a system rather from the signaller's point of view. The great thing in signalling is to get every message as short as possible. In signalling in the field with flags, or heliographs, or instruments of that kind, every letter that you can save in the message is of the greatest importance, especially when, as in messages of this kind, every letter has to be signalled at least twice, has to be collated in order that it may be got through correctly. I have, therefore, endeavoured to make rules which should produce as short a message as possible. For instance, in the case of that plan that we made at Uxbridge, the message actually sent through consisted, I think, of some 1,200 letters. That was in a somewhat early stage of our rules. We went on elaborating our rules, and in a very short time we had reduced that message to about 800 letters, and it still contained exactly the same information as the original 1,200. We have gone on in that way trying to reduce our message without depriving it of any accuracy. So far as the rough sketch goes, using columns and rows of about $\frac{1}{4}$ of an inch, there is practically no difference between my proposal and that of Colonel Melville. If you can get a telephone to use, certainly you do not want so elaborate a set of rules as those which we have devised; you can send any amount of information about the different points that you refer to without much waste of time. If the message has to be sent by electric telegraph or by heliograph, or much more if it has to be sent by flag, you do, I think, need a written message, because we find that mistakes cannot always be avoided. In signalling an ordinary intelligible message it is not very difficult to fill up a letter here and there in a word; the majority of letters in a word indicate what the word is, and you can fill up the letters that have gone wrong, because, even with the best signallers that I have seen, letters do go wrong sometimes, but if they go wrong in signalling a map of this kind, you must be able to put your finger on them, and have them verified from the other end of the line, and it is with that object that we have devised this system of prefixes and the other rules. So long as you use this simple 6-inch square and $\frac{1}{4}$ -inch columns and rows you require no prefix at all—you only use the rules of which I have spoken in explaining that first diagram, for making a line begin and stop, and saving a letter or two. But when you wish to be very accurate over any particular part of the map, for instance, if a reconnoitring Officer making a general sketch of the country wishes to give a more accurate description of a particular position that he sees, then he may draw that position much more carefully than the rest of his map, and in converting it into a message he will put that little hollow square over it and at once describe it on a very much more accurate scale without increasing the number of letters in the description. The only increase in the number of letters in the message will be the three letters which indicate the prefix of that little square. He would give the prefix, for instance, E, D, S, which represents the position of that $1\frac{1}{2}$ -inch square, in Fig. 4, and then he would go on using no more letters in his message for the very accurate scale than if he had been drawing on the rougher scale. I am greatly obliged to Mr. Pilkington for his remarks with regard to my suggestions in connection with information on the field of battle. It appears to me that something might be done in that direction. Unless some scheme is organized beforehand, either in this way or in some other, signalling parties get out of sight of each other: they are wandering hopelessly about the field looking for something to do, quite incapable of sending a message anywhere if they get one to send. I have heard signal Officers of the regular Army speak of the great difficulty that there is in keeping moving stations in sight of each other, and so far as I have knowledge of the subject, it appears to me that that difficulty is really very serious. If they can be kept together, the strings, so to speak, of the whole series of signalling stations being held by one man, it will be, I imagine, a very important point gained. I have nothing further to say except to thank Colonel Moncrieff very much for having taken the chair at this meeting this afternoon, and the audience for so kindly listening to me.

The CHAIRMAN: I must say I think that great credit is due to Lieutenant Glen for this most interesting lecture. A good deal of the details may, perhaps, have

been rather dry for the listener, but I think with the excellent plans that he has drawn out he has succeeded in making his rules for the abbreviation of messages thoroughly intelligible to us all. It appears to me that his system of signalling information in the form of a sketch, giving details of the position of troops, &c., is most valuable, and it will be a very great advantage at headquarters if they can get such information from distant outposts or cavalry screens without the delay of sending them by messenger on horseback. I can assure you that Mr. Glen has worked with extraordinary assiduity at this subject, and notwithstanding the large amount of time that he has to give to his own profession, he has been able to devote many spare hours to working out this system. I give him particular credit for having reduced the length of the messages in a most extraordinary way, and am quite certain that no one but an Officer thoroughly practised in signalling could possibly have elaborated the scheme which he has placed before us in the manner in which he has done. I am sure you will all unite with me in returning him our best thanks.

Wednesday, January 27, 1886.

MAJOR-GENERAL SIR ANDREW CLARKE, G.C.M.G., C.B., R.E.,
Inspector-General of Fortifications, &c., in the Chair.

ON LAND MINES.

By Major SALE, C.M.G., R.E.

THE subject of the paper as announced for the meeting of this afternoon is Land Mines, but the writer does not propose to touch upon that branch of military mining which involves the use of shafts and galleries and such like subterranean warfare.

He proposes rather to deal with that class of small surface defence mines which might be more properly termed land torpedoes.

At first sight it would seem an easy and obvious adjunct to the defence to place a number of small concealed mines in the attacker's path of advance, and in fact the use of land torpedoes has been from time to time suggested and attempted, but seldom with any satisfactory result; either the firing arrangements have been unsuccessful or the torpedoes have been exploded at the wrong moment, or—as too often the case—the person setting the mine has been blown up by his own torpedo; in short, hitherto land torpedoes have been but of little actual use.

Nor is the cause far to seek. In the first place, the range of destructive effect is very limited. If the torpedo is not concealed it can be avoided with ease, but if concealed it must ordinarily be either below the surface of the ground or masked in some manner.

This in itself is sufficient to restrict the horizontal effect, and throw up into the air nearly the whole force of the explosion.

It is remarkable how small is the horizontal effect produced by even large charges which are buried however slightly below the surface of the ground.

Then again the firing arrangements have been a frequent source of failure, mechanical mines having involved too much risk in setting and recovering, and electrically fired mines have failed at critical moments owing to the fuzes, firing batteries, or wires going wrong, or as very notably the case in the late operations at Suakin, mines have failed because detected by the enemy.

It should, however, be borne in mind that the land torpedoes hitherto used have for the most part been rough improvised arrangements, made for special occasions, unfamiliar to the men using them, and often faulty in mechanical details.

It would be rash to assume that, if properly devised land torpedoes

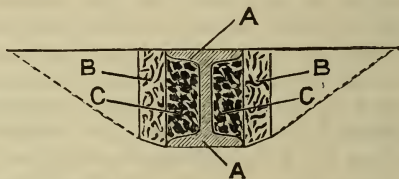
are to be had, simple and certain in action, and sufficiently portable and safe to be handled without undue risk, a notable effect might not be produced by them in warfare.

Let us examine in some detail the conditions to be fulfilled in an efficient land torpedo.

First.—As to the form of the mine, without reference to firing arrangements.

To be effective it must be readily concealed, and yet as close to the surface of the ground as possible, otherwise the horizontal effect will be almost *nil*, and it should be so made as to offer a maximum resistance to the upward force of the explosion in order to develop the horizontal effect to the utmost.

Where portability is not a great object this end can to a certain extent be attained (using gunpowder as the explosive) by the use of the form of case shown in the diagram, where AA is a strong steel dumb-bell, so placed as to form a sort of core for the charge, the upper disc of the dumb-bell being flush with the top of the mine and with the surface of the ground.



AA, Iron dumb-bell; BB, Layer of broken iron surrounding the charge.

It has been found that by experiments made at Chatham, and by trials made by the Confederates during the American War, that a core of this sort has an effect in increasing the horizontal power of the explosion, but it necessarily adds very much to the weight of the torpedo and complicates its construction, and moreover would be of but little or no use where charges of any of the high explosives are used.

Then again the torpedo should be surrounded with a sufficient quantity of fragments of metal, grape-shot, or bullets, to act as missiles, after the manner of an improved fougasse. For this purpose metal punchings are very suitable, such as are to be had in abundance in any factory for structures in wrought iron or steel.

Lastly, the torpedo should be fairly portable and sufficiently waterproof to resist damp and rain-water.

These requirements necessarily involve a very considerable weight, the steel core alone for an 8-lb. charge would be 17 lbs., and the surrounding charge of metal fragments not less than 160 lbs., so that a torpedo to meet the conditions above described could hardly be made to weigh less than 185 lbs., which would, considering the limited range of effect, be almost prohibitory for field service where transport would of necessity be limited.

The use of such heavy torpedoes must therefore be restricted to places where facilities exist for bringing up heavy stores.

But if we abandon the use of gunpowder and employ high explosives we may reduce weight to a minimum, the dumb-bell form may be abandoned, as the action of such explosives is so violent and sudden that any effective resistance to the upward force of the explosion could hardly be offered by any practicable form of case, and we can dispense with the surrounding of metal fragments as missiles, trusting to local supply, stones, &c., for charging the mine, or even to the simple shock of the detonation of these violent explosives.

In many of the proposed torpedoes this shock action is alone trusted to, and very exaggerated ideas have been held as to the range of such effect. One inventor has stated that the shock of a 6-lb. charge of blasting gelatine would necessarily be fatal to anything within a radius of 25 yards, the statement being professedly based on actual trial; another inventor has with the utmost confidence asserted that detonation of a charge of 300 lbs. of dynamite would be fatal to human life within a radius of a quarter of a mile, and in fact the most absurdly exaggerated ideas as to the forces of these high explosives are prevalent.¹

Attempts have been made to determine the radius within which the mere shock-action of the detonation of moderate charges of high explosives would prove effective.

To make a direct experiment is out of the question, we cannot make trials of this sort on living creatures, and all results obtained on inanimate objects are inconclusive,² but from observed effects the writer is of opinion that a 6-lb. charge of dynamite or guncotton would not—by mere shock-action—be fatal, or even inflict serious injury outside a radius of 6 yards.

Assuming, then, that high explosives are made use of for the more portable form of torpedo, we can reduce the necessary weight of the mine to but little more than the actual weight of the explosives; with mechanical mines a charge of 6 lbs. of dynamite or gelatine, with firing apparatus, all contained in a strong case, can be made under 10 lbs. in weight, and in a very compact and portable form.

With electro-firing mines the weight of the mine can be still further reduced, but here the weight of the electric wires is a serious item.

In view of the above considerations the writer is of opinion that two distinct forms of torpedo should be used, viz. :—

One for siege requirements where weight is not a primary consideration, and one for field requirements where extreme portability is

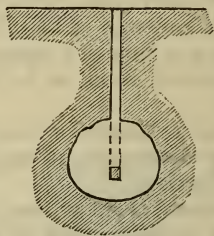
¹ The very limited range of the shock-effect of high explosives is strikingly shown by the fact that at the great dynamite explosion at Kimberley, Cape of Good Hope, in January, 1884, the explosion of 46 tons of powder and dynamite (including over 30 tons of dynamite) did no harm to men only 500 yards off in a straight line fully exposed to the direct force of the explosion.

² In the course of some experiments, in which it was attempted to gauge the force of the shock-action by the breakage of strong paper screens placed at various distances from the explosion of small charges, the writer was standing by a screen when it was shattered by the shock—the writer, however, feeling no inconvenience.

essential; the former to be made for the use of gunpowder with a special heavy case and surrounding layer of missiles, and the latter to be simply a charge of some high explosive enclosed in a strong waterproof case.

Where high explosives are at hand, there is a method by which a considerable charge—say 100 lbs. and upwards—of powerful explosives can be deposited under ground very quickly without the use of galleries, and with but little disturbance of the surface.

A hole is bored or jumped with an iron rod for, say, 6 feet deep, a 3-oz. charge of guncotton is then pushed to the bottom of the hole, and detonated, the explosion of this small charge by the powerful compression exerted on the surrounding earth forms a spherical cavity, whose lowest part is somewhat below the bottom of the original bore-hole.



Into this cavity cartridges of blasting gelatine can be passed, which can be detonated by a dynamite primer enclosed in a waterproof bag. As blasting gelatine is not materially affected by damp or wet, such a mine could be kept effective for a very long time, and would be extremely difficult to detect, owing to the very slight disturbance of the surface due to lodging the mine.

In very dry soils, such as occur in rainless districts, gunpowder might be passed into the cavity. Though such a mine could be well concealed, and could be made to contain a very powerful charge, a great proportion of the force of the explosion would be wasted in an upward direction, owing to the circumstance that the charge is placed at some distance below the surface of the ground; moreover, this method can only be used successfully where the soil is favourable.

Arrangements for Firing.

As regards the arrangements for firing the torpedo, the first and most obvious plan is to devise some arrangement whereby the charges shall be mechanically and automatically fired on the approach of the enemy either by treading on the mine itself or by tripping on wires, which thereby release a striker in the mine itself.

This in itself is a matter of great simplicity. In the American War a mine of this sort was used, in which the whole apparatus for firing consisted of a sort of metal knob, covered with a thin layer of fulmi-

nating composition, which was so compressed as to explode when subjected to a certain pressure.



This knob was covered with a cap of thin flexible metal, and was itself screwed on to the upper part of the torpedo.

Actual tread on this knob or the pressure transmitted by the bending of a small deck or platform placed over it sufficed to fire the fulminating composition.

Nothing could well be simpler, but unfortunately, also, nothing could well be more dangerous, in fact such a mine would be almost as dangerous to friend as to foe, both in setting and recovery.

It is, however, comparatively easy to devise a mechanically-fired mine which shall be certain and simple in action.

If this were all that is necessary the problem would be simple, but it is unfortunately also necessary to provide for the safe recovery of the mine when occasion requires. It is here that the difficulty arises, and although many ingenious devices have been proposed, none that the writer knows of provide sufficiently for the safe recovery of the mine, whilst at the same time allowing of the effectual concealment of means whereby the mine is to be rendered safe or inert for recovery.

The firing arrangements of most of the proposed mechanical mines consist of a detonating cap fired by a striker which is actuated by a spring held back by a trigger or some analogous arrangement, and locked by a safety-pin.

The mine is set whilst the safety-pin is in position, and when all is ready the operator retires to a safe distance, and pulls out the safety-pin by means of a line or lanyard attached thereto.

Safe recovery is usually provided for by a second line or wire, which actuates a safety-catch in such a manner that the operator can by pulling on the wire so set the catch as to prevent the disengagement of the striker. This in itself is an insufficient precaution, as the safety-line, being necessarily concealed, cannot be depended upon in its action; this makes it necessary to provide some mode by which it can be seen on approach if the mine is safe or not.

It will readily be understood that the necessity for an indicator makes the proper concealment of the mine a matter of the utmost difficulty. Probably the best mode of meeting this difficulty which has yet been devised is the method proposed by Major Bucknill, R.E.

In this device the mine is covered by a small and light triangular shaped board, the hauling on the safety-line not only sets the mechanism to safety but discloses the mine by drawing off the light covering board. Even this method, however, is not free from objection.

Perhaps the best possible arrangement would be that the torpedo

should be provided with two safety lines, one for setting by withdrawing a safety-pin to render the mine active, and a second for rendering the mine safe by withdrawing either the actuating spring itself or some part of the mechanism essential to its action, so as to make it absolutely certain to the operator when he has hauled in the safety line with this portion of the mechanism attached that the mine could be no longer in an active state, *e.g.*, a friction tube connected by a link with the firing gear; the removal of this link would absolutely sever all connection with the firing gear, and so ensure safety. Even, however, if an arrangement of this sort could be devised to work perfectly there would remain much risk in approaching mechanical mines after once set; the safety-line might be cut, or being concealed its locality might not be discovered, or the indicator might be concealed by earth, &c., rendering uncertain if the mine had been set to safety. So that it might be necessary to approach close and search for an active mechanical mine; a proceeding by which accident is almost ensured.

In the recent operations at Suakin, mechanical mines were used; and as the Arabs showed the most extraordinary keenness in detecting any kind of tripping-wire or safety-line, the torpedoes were set to explode when trodden on, and without safety lines for recovery. Owing to this a deplorable accident ensued, by which the life of a young and most promising Officer was lost.

Briefly, it may be said that mechanical mines are unsatisfactory, imperfect, and decidedly dangerous, and should not be used except under very special circumstances.

Electric Firing.

Most of the difficulties in the way of using mechanical mines do not hold good when we make use of electricity for firing.

The motive power which fires the mine does not or need not be in the mine itself, while groups of mines can be connected to one firing battery, which may be far from the mines; the moment this battery is disconnected these groups become necessarily inert.

There are no complications such as safety-lines, indicators, &c., the mines can be effectually concealed, and the contact mechanism, by automatic firing, may be of the very simplest possible kind.

Two serious drawbacks have hitherto attended the use of electricity for firing mines in the field: the necessity for using a voltaic battery and the need for considerable lengths of insulated wires.

For electro-contact firing we must have a battery which remains always ready to do its work directly contact is made, and is, moreover, sufficiently powerful for firing purposes, and sufficiently simple and portable for use in the field. None of the portable magneto-electric exploders will answer the purpose.

Hitherto such a battery has not been available; either there has been a necessity for the use of corrosive acids or the battery has been bulky, required careful manipulation, and could not be trusted to remain constant.

Recently, however, a battery has been introduced into the Service,

which seems to answer fairly all requirements: it is so simple that all that is required to charge it is to fill up each cell with water. It will remain ready for work for months without any attention, is quite powerful enough for a firing battery, is fairly portable, and is not unduly expensive; moreover, it is the battery which is now approved for use in military telegraph equipment, so that it is well known in the Service.

Such a battery has been practically tested by connecting it up with a series of dummy electro-contact mines laid out in the open ground.

Though these electro-contact mines (containing electric fuzes only) were of the roughest possible kind, and were almost entirely unprotected from wet and earth contact, though the mines were sodden with moisture and for some days covered with snow, the whole system, battery included, remained efficient for three months without any attention whatever, and during this time the dummy mines were from time to time fired by contact, and were uniformly found to act.

This test appeared to the writer to be conclusive as to the efficiency of the battery under Service conditions.

As regards the use of insulated wires no doubt this is a serious drawback to the use of electricity, but great improvements have been made in the manufacture of these wires, and samples are now to be had weighing only 97 lbs. per mile, and yet sufficiently well insulated, of good tensile strength (breaking strain 150 lbs.), and not having too high a resistance (26 ohms).

Electric fuzes were formerly a frequent source of failure, but now the electric low tension fuzes and detonators used in the Service are quite simple and reliable.

Upon the whole it appears to the writer that the advantages to be gained by the use of electricity so decidedly preponderate over the drawbacks, that this mode of firing land mines should in almost every case be preferred to mechanical methods.

In electro-contact mines it is by no means necessary that the contact apparatus should be in the mine itself; any number of these contact makers (which may be simple modifications of the ordinary bell-push) may be placed about, in front, or around the mine, and so arranged that by making contact by tread or tripping-wire, or even by any attempt to cut the wires, the one particular mine to which they are connected shall be fired without throwing out of action the other mines of the group served by the same battery.



A, Mine; BB, Contact makers.

The diagram shows the method of connecting up a group of contact makers with the mine ; one battery of twenty cells would serve almost any number of mines within a radius of 500 yards.

Any testing required is of the simplest possible kind, and is fully provided for in the electric testing gear which forms a part of the R.E. equipment in the field.

Having discussed the form and mode of firing land torpedoes, it remains to consider on what occasions such articles could be advantageously used in warfare, or if they could under any circumstances be advantageously used.

It may be conceded at once that under any circumstances the actual casualties caused by land mines would be but small, for one mine exploded with effect many would probably be harmless. Nor does it appear probable that torpedoes would ever be used for the defence of fortified positions in supersession of other modes of defence.

But as an adjunct to the defence to be used in places near the defended post where accidents of ground prevent an effective searching musketry fire, a few torpedoes might be employed with great effect. They would help to prevent the enemy from taking cover and collecting in such ground for a final rush. Or they could be used in conjunction with wire entanglement to check a rush where musketry fire would be weak.

If placed a few feet in front of the wire entanglement, and with their contact arrangements in connection with it, they would effectually check any attempt to demolish the entanglements, which, however, their explosion would not materially displace ; they could also be effectively used in conjunction with wire entanglement for defending the wide shallow ditches of earthworks.

For the defence of isolated posts in savage warfare where sudden night attacks are to be expected, electro-contact land torpedoes might be very usefully employed, both for their deterrent effect and also because they would serve as detectors or alarms.

It should not be forgotten that casualties caused by mines have more effect on *morale* than a far greater number of casualties caused by musketry fire, the sight of men being blown up by mines, combined with the knowledge or even supposition that the ground to be advanced over was mined, has been found to try the nerves of the bravest.

For mountain warfare there is also scope for the use of torpedoes. The roads through a mountain pass, defended at suitable points by a number of torpedoes skilfully concealed, could only be traversed by the enemy after a careful search for and hazardous removal of all the mines.

The utmost confusion and delay might be caused by the successful explosion of even one torpedo in such a road crowded with men and baggage animals.

By the use of concealed electro-contact land torpedoes, bridges and railways can be prepared at leisure for demolition, the friendly traffic can be allowed to pass up to the last moment, nothing more being

required for the setting of the torpedoes at the last moment but the connecting up of the wires from the concealed battery.

To be effective torpedoes should not be set where the enemy has the means of making a leisurely and undisturbed examination of the ground defended by them.

Upon the whole it appears to the writer that there are so many occasions on which land torpedoes could be used with much effect, and the difficulties in the way of using these appliances have been of late so much lessened, that in spite of the natural dislike to make use of such, as it were, underhand weapons, the time has come for adopting them into the Service, not as mere makeshifts, but as articles of store carefully worked out in all details.

It is essential to the proper handling of such weapons that the persons who have to make use of them shall be thoroughly familiar with all their details, mode of setting, &c. However simple and efficient a pattern of torpedo be provided there must inevitably be a number of small details which have to be attended to if success is to be obtained and accident avoided.

No instructions, however carefully prepared, can supply the place of experience gained by actual use. When knowledge of the use of such gear is acquired by reading only some detail is sure to be forgotten at the critical moment, and any error when dealing with concealed torpedoes—especially mechanical ones—means failure or even fatal accident to the user.

Note.—Since the reading of this paper the writer has been favoured with the subjoined account of some electro-contact land mines used with much effect at Suakin.

LAND MINES IN THE SOUDAN.

Mine laid out by H.M.S. "Carysfort" at Suakin.

Several guncotton mines, arranged to be fired at will by electricity from a fort, were laid out with but indifferent results. As a number of natives were allowed to go in and out during the day, from these the enemy no doubt got information, for on several occasions the wires were cut, the mine thus rendered harmless, and then carried off bodily.

About this time the night attacks were very harassing, and it was most desirable to check them, so a mine was arranged as follows:—A guncotton charge to be fired by electricity was placed in a cask with two circuits fitted to it, one starting from an electric battery in the fort, then to a firing key there, then away to the electric fuze in the mine, and so back to the battery; the other being from a battery in the cask to a circuit closer, which would only complete the current when the cask was on its side, through a length of wire going outside the cask by the bung-hole with the end insulated, this to be joined to another insulated end, and this wire back through the bung-hole to the battery. It will be seen, then, that the mine could be fired in two perfectly different ways—either at will from the fort, or by the circuit closer in the mine making contact, which would

happen if it were laid on its side, the wires being then joined up. A hole was then dug and the cask placed in it; the two wires coming out of the bung-hole were then joined at a safe distance from the mine, and as the mine did not fire it was evident that the circuit closer was not making contact, and so the bight could be stuffed into the bung-hole with safety. At night the enemy came, cut the wires leading to the fort, and hoisted the cask out of the hole. They then laid it on its side, and the charge exploded with disastrous consequences to them. After this the night attacks ceased for two months. An explosion at a distance was heard some time afterwards, and it appeared that the Arabs, finding one mine had gone off after the wires were cut, considered the ones they had carried off untrustworthy, and set fire to the whole of them; as the detonators were presumably still in the charges, an explosion occurred which did great damage.

Note.—The above account is given from what has been heard of the mines at Suakin, and is from memory.

Commander A. KINGSCOTE, R.N.: I should like to say a few words about my own experience in the Navy during the Zulu war, and also at Suakin, when commanding the "Woodlark." In the Zulu war I was left in command of both banks of the Tugela, with the men of the "Tenedos," the ship that I was First Lieutenant of, by Lord Chelmsford, and I asked for and had brought up 100-lb. torpedoes from the ships at Durban, and laid them out as fougasses at each angle of our redoubt called Fort Tenedos. I found them most effective for frightening the natives and for actual work. I can also answer for the small stake mines laid out at Ekowe, as explained by Major Sale. I was not there, but brother Officers told me of them, and that they answered the purpose very well in frightening the natives, but that was all. I must say my own experience about land mines is that they must be electrical, and not mechanical, to be of any real good in actual civilized warfare. If friction tubes are used, as instanced by the lecturer, damp or wet weather affect them at once: this we find on board a man-of-war, where the greatest care is taken of them. Mines for effect must be electrically fired by hand from the redoubt or place of observation. I should also like to say a few words on what I saw at Suakin with regard to laying out electro-mechanical mines to frighten the natives away. The best one I saw there was one fitted with naval stores, the mechanical part consisting of an upright tube half full of mercury, which on being well shook, slanted, or turned over, made contact, and by aid of a battery inside, blew up. Early one morning in August, one and a half years ago, twenty-seven natives were killed by one of these, and they are by far the best of this class with the battery and mechanical arrangement in the mine. When the wretched men took up the mine and turned it over, after cutting the dummy wires, it went off at once. On another occasion, another mine of the same kind was carried all the way from near Suakin to Handoub, as much as 6 or 7 miles, and then when they put it down, it turned over and blew up, some fifteen men being killed. I think electro-mechanical mines are useful for ordinary native savage warfare, especially to frighten them; but I do not believe in them for actual fighting against civilized nations—the only ones of use then would be electrical mines fired by hand.

Captain M'Evoy: I should like to make a few remarks with regard to the land mines employed during the American war, on the line of the James River and on the peninsula about Yorktown, and also with regard to those employed about the fortifications below Richmond. They were of a much cruder form than even Major Sale has pointed out. I saw many thousands of them, and those that I saw were simply 9-inch spherical shells, with what was known as Rain's sensitive fuze, which went off with a pressure of 8 ounces. These shells were fitted with fuzes of that sort, placed in the ordinary fuze hole in which fuzes are used when shells are

employed for artillery. They were covered with a simple conical tin case, which slid down and fitted tightly over the spherical form. The top of the tin case stood a little off the fuze, so that the pressure of a man's foot forced it down and exploded the shell. There were a great many lives lost by the attacking parties on the peninsula, by these mines. They were put in rows, and the earth was thrown over them to the depth of from 3 to 6 inches. The earth was so arranged as to make a slight cover for a red piece of paper or cloth, which could be seen from the fortifications, while the enemy attacking could not see it, the earth being banked up on the side towards the enemy. There was considerable loss of life from these mines in the attacks on Forts Harrison and Gilmore, below Richmond. Fort Harrison was captured, but Fort Gilmore was not, the attacking parties being repulsed mainly by the land mines. A great many land mines were employed about Savannah and Mobile, and were reported to have been very effectual against attacking parties. Reports were made to the department in Richmond to which I was attached, of attempts to employ electrically arranged mines. The most notable instance, I think, was in connection with the mines at Fort Fisher at the mouth of the Cape Fear River. The fort, it will be remembered, was subjected to a severe bombardment, forty vessels with 300 guns played on it nearly all day, while a heavy land force waited to make the assault, which was finally delivered at night. The severe bombardment destroyed all the electrical mines which were laid from 3 to 5 feet under the earth. They were mainly intended for the assault which was expected as soon as the bombardment had ceased, but the heavy shells from the guns of the fleet ploughed up the ground and destroyed the wires and mines, so that when the assault was delivered late at night, the fort was carried, after severe fighting, the mines being perfectly useless. I have not heard of the employment of electrical mines about Petersburg, which may, however, have been the case. The mechanical mines were sometimes called emergency mines. They were only put down in cases of emergency, and taken up as soon as they could be dispensed with. I should think their moral effect was greater than their actual effect, but their actual effect was not altogether *nil*. Many attempts have been made to improve land mines. I have done a little inventing in that line myself. I should think that a friction tube could not be very effectual. All who have had any practice in pulling a lanyard and firing a tube in a gun must know how hard a pull it takes. I should think a man must bring a considerable strain on the wire to fire a friction tube in a land mine. It seems to me that the most certain land mines, mechanical or electro-contact, would be those that acted from a direct pressure brought upon them, and where everything connected with the firing arrangement would be inside of the mine itself. Guide wires coming to a point, and reaching mine after mine, might be found to be a safe means of pulling down and taking up the mines.

Colonel SCHAW, R.E.: I should just like to remind Major Sale (no doubt he forgot it in preparing his lecture), that there was a remarkable application of torpedoes or land mines lately, which we have all read about, namely, at the defence of Khartoum. General Gordon used them very largely and successfully, and they were extemporized mines. As far as we know he had only lucifer matches as his means of ignition, and yet he produced remarkable effects. The dryness of the climate no doubt helped him, and his own great mechanical genius helped him too. I wish to draw attention to it as an instance of mines being used very successfully with imperfect means.¹

¹ In reply to Major Sale's observation, it is to be noted that the accident he refers to, by which a native, whom General Gordon had made his commanding engineer, lost his life, can hardly be accepted as a reason for ignoring these extemporized land mines. Could any other mode of defence have been employed which would have produced such results with so little loss to the defenders? And have we not to deplore the loss of a promising Royal Engineer Officer at Suakin when dealing with land mines, prepared by English mechanics, with all the resources of civilization to aid them? Let us award ungrudging honour to General Gordon for the wonderful defence of Khartoum, in which land mines played so prominent a part; but at the same time we must not slacken our efforts to work out a pattern of land mines which shall combine the maximum of danger to enemies with the minimum of risk to those who employ them.—H. S.

Colonel MONCRIEFF, C.B. : I would only make one remark. In the Crimea, the Russians made mines of that description, and I happened to associate with some of the Officers, who considered that nothing daunted the men so much as those mines. They had difficulty in getting them to go about, and the casualties were very few.

The CHAIRMAN : I am afraid that the subject of our lecture this evening has hardly reached that stage in which there is very much difference of opinion with reference to the application of one system or another ; and it is due to that rather than to any lack of interest taken in the subject that we have had so few observations offered upon the interesting lecture by Major Sale. I shall now ask him, if he desires to make any further observation, to do so now, and not longer detain you.

Major SALE, in reply, said : I have very little more to say, gentlemen ; but referring to the case of Khartoum, it had not escaped my recollection. But in the first place, the information with regard to the mines was exceedingly scanty. One heard the bare fact that lucifer matches had been used for firing the mines, which we know could only have been under extraordinary and exceptional conditions of climate, &c. We heard that they had produced an effect, but no precise information concerning them had reached us. We did, however, hear that the engineer employed on them had been blown up. I hardly took that as an encouragement for the use of these mines. With regard to the use of the friction tube for the firing of mines, the direct pull no doubt is considerable (60 to 70 lbs.). What I suggested was that a powerful spiral spring should be held back by a trigger, and that disconnection should take place by pulling out the connecting link. That I take to be as near perfect safety as you could have with any mechanical mine ; but at the best, as I have endeavoured to bring to notice, mechanical mines are clumsy and dangerous.

The CHAIRMAN : It is now my duty to ask you to give your thanks to Major Sale for the lecture he has given us. There is one little point to which I may call attention with reference to the construction of a paragraph in the paper. As it is written one might be led to believe, as I was in the first instance, that the accident at Suakin was from an electrical mine. It was not : it was from a mechanical mine as we know. The subject is now being carefully considered by the Officers who are responsible for this measure of defence, and, speaking to you and to the country generally, I may say I think it will be found in a very short time that in this character of defence we shall not be behind other nations. I have every hope, in fact every confidence, that we shall be able to organize a defence of this kind which will be fairly safe and also effective. It will now only be necessary for me to ask you, gentlemen, to allow me to return our thanks to Major Sale for his interesting lecture.

Friday, January 29, 1886.

GENERAL SIR C. P. BEAUCHAMP WALKER, K.C.B., Vice-President, in the Chair.

THE USE OF PIGEONS AS MESSENGERS IN WAR AND THE MILITARY PIGEON SYSTEMS OF EUROPE.

By Captain H. T. W. ALLATT, Duke of Cornwall's Light Infantry, &c.

THE maintenance of communications in war is of paramount importance. A reliable and rapid system of communication may be said to be an essential element of success. The methods employed will vary with the many different conditions under which the military operations are conducted. Mounted messengers, railways, and telegraphs may be classed as the ordinary means by which intelligence is conveyed, the value of each depending upon the rapidity of transit.

Of these the electric telegraph is obviously the most valuable and the most satisfactory, but it is at the same time the most delicate and the most liable to interruption or destruction. It is therefore imperative to consider in what manner messages can be safely and expeditiously transmitted to their destination when telegraphs fail, and railways and human messengers are too slow to be of any value or cannot be used. We in England are apparently somewhat behind-hand in the solution of this problem, although many of our recent wars have afforded favourable opportunities of studying it.

On several occasions we have put up with the interruption of our communications for more or less lengthened periods. We all remember the isolation of General Roberts and his troops in Cabul. In the Zulu and Boer Wars several of our posts were cut off. In General Graham's campaign of 1883 our telegraphic communication between Suakin and Berber was constantly interrupted, sometimes for several consecutive days. In the expedition of the unfortunate Hicks Pacha, no attempt was made to maintain communications. In 1885, when Sir Herbert Stewart led his little force across the desert to save Khartoum, no communication was received from him for a full week after the news of the fight at Abu-Klea. And, lastly, in the recent Burmah War no news was received from the front between the 21st and 27th November, 1885.

The application of other and extraordinary methods of correspondence becomes necessary under any of the following circumstances:¹—

¹ See "Kriegs-Telegraphie," by R. von Fischer-Truenfeld, Berlin, 1879.

1. When the necessary supply of materials for the construction of the telegraph is not forthcoming.
2. In communicating to and from an invested place.
3. In countries where the establishment of the telegraph is the work of much time and labour, as in mountainous or swampy districts, &c., or where the telegraph cannot be efficiently guarded.
4. In combined operations between a moving fleet and coast fortresses or land forces.

All these cases, except the second, can usually be met by the application of signalling. The excellent work done by our signallers in Afghanistan, in South Africa, and in the Soudan is known to most of us. There are, nevertheless, conditions under which the establishment of signal stations becomes a work of difficulty owing to the presence and activity of the enemy, to the topographical peculiarities of the country, or to atmospheric causes. In such cases long-distance signalling cannot always be established, and if established, it might not be a desirable method to employ. The prominent points chosen as transmitting stations would be precisely the ones that would be first seized by an enemy, and even if such points were occupied and guarded, a civilized enemy might be able to read every message that was signalled.

Another case is the absence of suitable points on which to establish stations. This difficulty was encountered by the signallers with Sir Charles Warren's force in Bechuanaland, and is thus recorded:¹ "The country between Maritzani and Mafeking consists of long rolling plateaux, covered with thick bush and thorn trees, rendering signalling without artificial aid impossible. A series of mounds had therefore to be constructed as rapidly as possible, and lanes cut through the bush and thorn trees, which of necessity occupied so much time, that through communication was not established until a week after General Warren's arrival at Mafeking." Lastly, any means of communication which depends upon the deciphering of signals exhibited at a distant station is necessarily dependent upon contingencies of weather. Thus we find that the interesting series of military signalling operations which were carried out between Richmond and Portsmouth in August, 1884, were very much interfered with by the atmospheric surroundings, "which on two successive days prevented the use of the heliograph except at rare intervals, and then only for a minute or two at a time." In 1885 better results were obtained, but it was found that "the drift of the smoke from London made it impossible for the signal party at the station on the Epsom Downs to discern more than the barest outline of the next point of observation some 14 miles distant."²

Having regard to these and similar cases in which we cannot look to the signalling staff readily to establish communication, it becomes

¹ See "The Military Telegraph Bulletin," p. 153, 15th October, 1885.

² Pigeon races with young birds took place in the South of England on each of these days in 1884 and 1885.

necessary to investigate the merits of other methods which suggest themselves for consideration.

The application of balloons is confined to very narrow limits. Despite the great improvements both in speed and steering power lately effected by French *aéronauts*, they are not yet in a condition to undertake so important and delicate a task.¹ During the siege of Paris sixty-four balloons left the capital. Two, of which no tidings were ever received, were probably lost at sea; five were taken by the Germans, viz., three of them in the occupied parts of France, one in Bavaria, and one in Prussia; six were carried into Belgium, five into Holland, and one landed in Norway. The remaining forty-five descended, more or less successfully, in French territory not in occupation of the enemy.² An attempt was made by Monsieur Tissandier, the well-known *aéronaut*, to reach Paris in a balloon, but without success. What the future may bring forth in the way of improvements in *aéronautics* cannot even be estimated at the present time, but until some radical change takes place it is evident that balloons are too much at the mercy of the winds to be depended on either for accuracy or speed.

The only remaining medium for carrying information is the intelligent, hardy, incorruptible, and home-loving messenger pigeon. To the services of these birds the Parisians were indebted for the only news that reached them from outer France, during the four and a half dreary months that the investment lasted.

Before proceeding further, it is necessary to make some allusion to the name by which pigeons which fly long distances are known in this country. It is a common error amongst those whose love and knowledge of pigeons are derived from the process which usually follows the appearance of a bunch of their innocent little toes protruding from the centre of a pie-crust, to apply the term "Carrier Pigeon" to these birds. This from a pigeon fancier's point of view is an unqualified mistake. The English carrier is a purely fancy variety, bred up to an artificial standard of perfection, but quite useless as a messenger pigeon: during the past 200 years this breed has never been employed in this country for that purpose.³

Although undoubtedly the descendants of the Persian carrier⁴

¹ There is an excellent article on "Carrier Pigeons in Warfare" in "Colburn's United Service Magazine" for March, 1885.

² "En Ballon" pendant le Siège de Paris," by Gaston Tissandier.

³ In Moore's "Columbarium" (1735), it is stated that good carriers are too valuable to be employed in this manner, and that pigeons called "Dragons" and "Horsemen" are the breeds used as messengers in England.

In a book published in 1694, called "Mercury, or the Secret and Swift Messenger," by John Wilkins, "late Lord Bishop of Chester," there is the following paragraph: "There is a smaller sort of pigeon of a light body and swift flight, which is usually made choice of for such particulars; and therefore the kind of them is commonly called by the name of carriers." The description "light body" could not be applied to the true carrier even in those days. The reverend author was evidently not a pigeon fancier.

⁴ This is sufficiently proved in "The Variations of Animals and Plants under Domestication," by Darwin. Moore also states "the original of these pigeons came from Bazora in Persia."

pigeons that were employed as messengers in that country some 700 years ago, the English show carriers of to-day have long since completely lost the attributes which gave them their name. Like all highly developed fancy breeds they are often delicate, and are deficient in the strength, the intelligence, and the vigorous constitution necessary in a messenger pigeon. They may be recognized by the great length of face and beak, and by enormous excrescences, called wattle, at the base of the beak and round the eyes. We know, however, that the strikingly peculiar appearance of the present show carrier is due to careful breeding by English fanciers, and existed to a very modified extent in the original imported bird.¹

The pigeons used at the present period throughout Europe as messengers are called by English pigeon fanciers "Homers" or "Homing Antwerps." The French, Italian, and Portuguese call them "Messenger Pigeons." The Germans apply the term "Brief-Taube" to them, and the Belgians have called them "Pigeons Voyageurs" for over half a century. It may be argued—and with some show of justice—that the Homer's proper appellation is "The Flying Carrier," a distinction to which the fancy carrier cannot pretend. Be that as it may, I have preferred, in the presence of this established unfortunate misnomer, to follow the example of our foreign neighbours, and to apply the term "Messenger Pigeon," as most suitable to these hardy little travellers.

The large number of messenger pigeons now spread over Europe may be said to be of a general uniform type, although considerable variations sometimes exist in different individuals of the breed, especially to the critical eye. They are all descendants of the "Pigeon Voyageur" of Belgium. The Persian carrier, said to have been first brought to Europe by Dutch sailors, is probably the original progenitor of the species. In Holland, where we shall see pigeons were first used in Europe as messengers in war, the Eastern carrier must have become more or less crossed with local breeds, and its flying properties chiefly considered. From Holland the mixed breed in all probability found its way into Belgium, and its blood was thus infused amongst Belgian pigeons.²

It is hardly necessary for me to remind you that a pigeon cannot be taught to "fetch and carry." No amount of training will make him fly in any direction but that in which he believes his home to be. It is for man to adapt to his own ends, to utilize for his own human purposes, the extraordinary tenacity with which the domestic homing pigeon seeks to regain his loft.

¹ The gradual development of these fancy points is traced by Darwin in his "Variations of Animals and Plants under Domestication." The original Persian carrier was somewhat similar in appearance to our English "Dragon" pigeon.

² Dr. Chapuis, in "Le Pigeon Voyageur," does not go so far back as this. He thinks that the "Pigeon Voyageur Belge" is the result of a cross between the French owl pigeon, the short-faced, thick-beaked "Pigeon Camus" and the English Dragon. The Antwerp Camulet—a high-flying Tumbler—is usually held to be one of the crosses used in the production of the Voyageur. It is curious that the Dragon, which is clearly a descendant of the Persian Carrier, should have been used by the Belgians to improve their breed of voyageurs.

The employment of pigeons for transmitting intelligence may be traced back to a very early period. The use of the dove by Noah points to a knowledge of its habits and peculiarities. Anacreon, in the sixth century before the Christian era, wrote an ode in which he alludes to pigeons having been used for transmitting love ditties to beautiful damsels. The early navigators of Egypt, of Cyprus, and of Candia are recorded to have used pigeons when they neared their native shores to advise their friends of their return. Varro, who died twenty-eight years before the Christian era, alludes to their employment as messengers from the Olympian Games. Pliny, the soldier, the naturalist, and the historian, is the earliest author who records the application of their use to military purposes. He informs us that during the siege of Modena, B.C. 43, Consul Hirtius, advancing to the relief of his colleague Decimus Brutus, who was besieged in Modena, communicated to him by means of a pigeon.¹ He adds, "Many are mad with the passion of these birds, and build towers for them on the roofs of their houses, and speak with pride of the long pedigree of each."

It is evident, therefore, that the Romans utilized pigeons as letter-carriers. Some writers assert that by this means Julius Cæsar became acquainted with surprising rapidity with the risings in Gaul, and was able to throw his legions into the disaffected districts at the first signs of revolt.

The wars of the Middle Ages, especially the Crusades, afford several examples of the successful application of pigeons for the transmission of messages. About the middle of the twelfth century Nour-Eddin, Sultan of Bagdad, added largely to his dominions by his conquests in Syria and Egypt. When his Government was firmly established in his newly acquired territory, he ordered that pigeons of a certain breed were to be kept in all castles and in all the strong places of his dominions. Towers were built at intervals over a large portion of the country to serve as pigeon houses. In 1167 he originated a system of communication by pigeon between Bagdad and all the important towns of Syria. This organization was afterwards completed and extended to Egypt. A regular service was established between Egypt and Syria.

The central station appears to have been fixed at the palace of Cairo. From that point radiated lines of pigeon stations towards Alexandria, towards Damietta, and towards Gaza. This last town communicated with Jerusalem, Damascus, Bagdad, and Aleppo. The distance between stations varied considerably, but the average, according to Dr. Chapuis, was 50 miles.

The institution of these State pigeon establishments was considered

¹ *Quin et internuntia in rebus magnis fuere, epistolas adnexas earum pedibus, obsidione Mutinensi in Castra Consulium Decimo Bruto mittente. Quid vallum, et vigil obsidio, atque etiam retia omne prætentata profuere Antonio, per cælum eunte nuntio? Et harum amore insaniunt multi: super tecta exedificant turres iis, nobilitatemque singularum et origines narrant vetere jam exemplo. L. Axius eques romanus ante bellum civile Pompeianum denariis quadrigentis singula paria venditavit, ut M. Varro tradit. Quin et patriam nobilitavere, in Campania grandissimæ provenire existimatæ.*

of so much importance for the public safety and tranquillity, that large sums were annually assigned to their maintenance. This pigeon post was kept up, with but little interruption, till the year 1258, when it became neglected, owing to political disturbances in Bagdad.¹ On several occasions it rendered signal service to the Syro-Egyptian Empire. During the siege of Acre by Richard Cœur de Lion (1189—1191), the town kept up a constant communication with the Sultan Saladin by this means. The news of the landing of Saint Louis and his crusaders at Damietta, in 1249, was conveyed by pigeon to Cairo and to other towns of the Empire. Joinville writes:—"The Sarassins communicated to the Soudan by means of *Coulons Messagers* that the King had arrived."

Many of the old pigeon stations of Egypt appear to have been in existence up to the end of the last century,² and one of the last of them, in the garden of Kiamil Pasha in Cairo, is said to have disappeared in 1801.³ Voltaire states that he was assured on unimpeachable authority that the ancient custom of pigeon flying is still in vogue in Persia, in Arabia, and in other Asiatic countries where telegraphs do not exist.

The siege of Candia by the Venetian Admiral Dandolo, at the beginning of the thirteenth century, is said to have been materially shortened by the receipt of messages brought by these birds from the island.

The first messenger pigeons brought to Europe were probably Persian carriers, "being sometimes brought by shipping and sometimes in the caravans."⁴ When the Spaniards under Frederick of Toledo invested the Dutch town of Haarlem in 1572, the besieged received communications from the Prince of Orange at Delft (some 30 miles distant) by means of pigeons. At the Spanish siege of Leyden in 1574, the Prince of Orange communicated with the Burgomaster of the invested place in a similar manner. The garrison was on the point of surrendering when a message reached them by pigeon that the dikes of the Meuse and of the Yssel had been cut by order of the Prince. The receipt of this communication saved the place from falling into the hands of the enemy, and the Prince of Orange, in recognition of the important services of the pigeons during that memorable siege, ordered that they should be fed at public expense, and, after their death, they should be preserved and kept in the Town-hall.

The bombardment of Antwerp in 1832 supplies another example of the successful use of pigeons as messengers in war.

Carrier pigeons have also their history amongst the Chinese. Sir

¹ This account of the Syro-Egyptian Pigeon System is taken from "Le Pigeon Messenger," by La Perre de Roo, and from "Le Pigeon Voyageur," by Dr. Chapuis. These authors got their information from the writings of M. de Volney.

² Alexandria and Cairo appear to have communicated by pigeons with Aleppo as late as 1745; see "Le Pigeon Messenger," p. 38.

³ Mr. Borg, H.M. British Consul at Cairo, informs me that pigeon lofts were first built there in 1173, and that the Egyptian stations were some 12 miles apart.

⁴ Moore's "Columbarium," reprinted from the original edition of 1735 by W. B. Tegetmeier, 1879.

John Maundeville, knight, warrior, and pilgrim, who penetrated to the border of China in the reigns of the second and third Edwards, writes:—"In that Contree and other Contrees bezonde whan . . . men holden sege abouten Cytee or Castelle, and they withinner dur not senden out messagers with lettere . . . they maken here letters and binden them to the nekke of a Colver and letten the Colver flee, and the Colveren be so taughte that they fleen with the letters to the very place that men wolde send hem to."¹

We are also informed in "The Natural History of the Island of Hainan" by Swinhoe, that pigeons are still used in China as letter-carriers.²

Taking leave of the consideration of the employment of pigeons in former centuries, let us pass to their utilization in modern times.

Siege of Paris, 1870-71.

The most interesting chapter in the history of the messenger pigeon is that which records its services to the French during the siege of Paris. It became evident, immediately after the capitulation of Sedan, that the French capital would shortly be invested. There existed in France at that time several pigeon flying societies, some in Paris and some in the provinces. These societies were well aware of the use that could be made of their birds in case of a siege. On the 2nd September, 1870, Monsieur V. La Perre de Roo, an eminent Belgian ornithologist, and one of the most experienced breeders of homing pigeons in Paris, wrote to the Minister of War suggesting that all trained pigeons belonging to Paris should at once be collected and sent into the provinces, while as many as possible should be got into Paris from different parts of France.³ On the following day, however, the Imperial Government was upset, and no notice was taken of the letter. The German advance on Paris continued, and Monsieur Cassiers, President of the Pigeon Society, "L'Espérance," of Paris, sought a personal interview with General Trochu, to offer the services of the trained birds belonging to members of his Society. In the absence of the General, he was received by a subaltern Officer, who intimated that his proposition was ridiculous, and bowed him out politely. When the Germans arrived under the walls of Paris, not a single pigeon had been sent out of the capital. It seemed, therefore, impossible to receive any news from the provinces. Eight hundred birds belonging to various Columbarian Societies in the north of France had, however, been brought into Paris before the investment, and were housed in the aviaries of the Natural History Museum. These proved most useful as messengers, and were for some time the only means by which the invested capital communicated with outer France. On 23rd September the first balloon

¹ The Penny Cyclopædia, "Columbidæ."

² "The Homing or Carrier Pigeon," by W. B. Tegetmeier, 1871.

³ See "Le Pigeon Messager ou Guide pour l'élève du Pigeon Voyageur," by V. La Perre de Roo. Paris: Deyrolle Fils, 23, Rue de la Monnaie.

("The Neptune") left Paris, carrying a large number of official and private documents. There was no means of ascertaining whether the balloon had landed safely and clear of the enemy. At the suggestion of Monsieur Van Rosebeke, the Belgian Vice-President of "L'Espérance," the next balloon ("The Ville de Florence") that started from Paris with despatches on 25th September, at 11 A.M., also carried out three pigeons. At 5 P.M. the same day the birds had returned with the message, "We landed safely at Vernouillet, near Triel. We will take official despatches to Tours. Bags of letters will be distributed." This was the first message that reached Paris after the arrival of the Germans. The Parisians, the large majority of whom had never before heard of the capabilities of pigeons, were amazed at this unexpected success. The illustrated papers were filled with drawings of the wonderful messengers, and printed fabulous tales of their performances. Nearly every balloon that left the capital after this date carried out pigeons.¹

The fifth balloon, which started on the 7th October, carried out Monsieur Gambetta, to whose care some of the best pigeons in Paris were confided. On the following day at 5 P.M. one bird returned with the news that the balloon had safely landed beyond the reach of the enemy. This bird was probably the best in Paris, having won the first prize in a race from Auch (600 kil. from Paris) in which there were 1,600 starters. (During the siege this pigeon entered Paris four times with despatches.) None of the other birds confided to the care of Monsieur Gambetta ever returned, although they were known to be of unusual excellence.

On account of these and other losses of good birds, Monsieur Rampon, the Postmaster-General in Paris, determined to entrust the precious winged messengers to the care of persons who understood their management, and not to trust them to aéronauts who were unaccustomed to handle them, who often liberated them in the evening, perhaps with an adverse wind, when the bird had 120 miles to fly home, and sometimes in fog or rain, instead of waiting till the weather improved.

Messieurs Cassiers, Van Rosebeke, Traclet, Thomas, and Nobécourt accordingly left Paris in five successive balloons between the 12th October and the 18th November, and they all eventually reached Tours with the pigeons of which they had charge, except Monsieur Nobécourt, who was made prisoner by the Germans. Six birds belonging to him returned to Paris, each bearing a false despatch attached by the enemy who had captured them. There was, however, no difficulty in detecting the deception, on account of the manner in which the messages were attached, and of the signatures appended.

¹ Dr. Chapuis states that each of the 64 balloons that left Paris, except "The Neptune," carried out baskets of pigeons. The maintenance of the pigeon post was thus dependent upon the departure and successful landing of the aéronauts. No other French town could have furnished materials for these balloon expeditions, and no other besieged place had any communication either way with the exterior. "Les Postes et les Télégraphes pendant la Guerre," by F. F. Steenackers, formerly Director of Posts and Telegraphs, has been chiefly used in writing this account of the work done by the Paris pigeons.

To employ several pigeons simply to announce the landing of a balloon was a waste of valuable messengers, which was very ill-advised, and the practice was soon put a stop to. Orders were given that all birds sent out of Paris in balloons were to be taken direct to Tours, by special train if necessary, and on arrival there were to be placed at the exclusive disposal of the Delegation.

A large room at the Prefecture of Tours, from which the furniture was removed, was fitted up with perches, &c., and converted into a pigeon loft. In this loft were placed all the birds that arrived (by balloon) from Paris. It was under the charge of Messieurs Cassiers, Van Rosebeke, and the other colombophiles who, as we have seen, had been sent out of Paris for this duty.¹ Monsieur F. F. Steenackers was Director-General of Telegraphs and Posts (including pigeons) at Tours. Birds selected for the journey into Paris were taken by train (express or special) in the early morning from Tours to the furthest point north that could be safely reached, thus reducing as much as possible the distance they had to fly. For some time Blois was a favourite point of departure.² While the Government was at Tours, from middle of September to 11th December, 219 pigeons were tossed, and although the majority of the birds were lost, some copies of all the despatches they carried reached Paris. The average number of birds liberated each time was about five, all of which carried copies of the same despatches. From the time of the removal of the seat of Government to Bordeaux,³ the difficulties of the pigeon post increased enormously, on account of the greater distance to be flown and the severity of the weather. From 11th December to 2nd February (the date of the capitulation of Paris), 83 birds were tossed, but very few of them ever reached the capital. 363 pigeons were sent out of Paris in balloons, of which 302 were liberated; the deficit of 61 being due to illness, deaths, and to the number at first tossed by *aéronauts*. Out of these 302 birds, only 73 reached Paris with despatches, viz., 9 in September, 21 in October, 24 in November, 13 in December, 3 in January, and 3 in February.⁴ Besides these, several arrived with no despatches attached.

As, however, some birds performed the journey more than once, there were but fifty-seven pigeons that actually accomplished the task that

¹ The composition of the staff was as follows: Monsieur Godeaux, Head of Extraordinary Correspondences, resigned 23rd October, and succeeded by Monsieur Feillet; Monsieur De Lafolloye, Inspector of Telegraph Lines, in charge of communications by pigeons; Georges Blay, Auguste David, duties were to liberate the birds as near Paris as possible; Messieurs Cassiers, Traclet, Van Rosebeke, and Thomas, in charge of the birds and of the expedition to the place of liberation.

² Blois to Paris is about 100 miles, Tours to Paris about 130 miles, Poitiers to Paris 180 miles.

³ Whilst the Government was at Bordeaux, the pigeons were kept in a specially prepared room at the Prefecture at Poitiers.

⁴ These figures are taken from Monsieur La Perre de Roo's book. The "Bulletin de la Réunion des Officiers" of 11th July, 1885, gives the following table of results which is not identical with Monsieur La Perre de Roo's figures:—

was set them.¹ Neither can we be astonished that the losses were so numerous. Many of the birds used were reliable and well trained, and these were the ones which rendered a good account of themselves. One bird was taken out of Paris six times, and flew the return journey after each balloon trip. One of Monsieur Van Rosebeke's birds returned four times, and another three times. At least two birds are reported to have reached home badly wounded. The majority of the pigeons placed at the disposal of the Government at Tours and Bordeaux were, however, untried and almost useless. Thus Monsieur La Perre de Roo states that from the 26th October to 12th November not a single bird reached Paris, because during that time a lot of pigeons were used that were quite untrained, but which the person in Paris to whom they belonged had insisted on placing at the disposal of the Government.

One great obstacle to the success of the pigeon post into Paris was the weather. It is quite useless to liberate birds on very thick and stormy days, a consideration to which the Government at Tours and Bordeaux paid little or no attention. In the report of Georges Blay, who had charge of the liberation of the birds, passages such as this frequently occur: "In spite of the bad weather we liberated the pigeons in accordance with your orders. There is no chance of the birds making Paris." The winter of 1870-71 was exceptionally severe. The ground was often covered with snow, which confused the birds in their efforts to find their way home. The cold was intense. Fogs were of frequent occurrence. The days were short. Added to this, the pigeons were exposed to the pursuit of hungry birds of prey, and to the unceasing attention of the enemy; for if several of them returned home wounded many doubtless were fatally hit. It is also a fact that pigeons bearing despatches were shot by French peasants, who were totally ignorant of the important services the birds were rendering to their country. Monsieur La Perre de Roo states that at Blois six pigeons with despatches were killed by a French peasant, and Monsieur Steenackers mentions another instance of destruction.

A decree was issued from Bordeaux rendering any person who killed a pigeon carrying despatches liable to imprisonment for a

| Date. | Number of birds liberated. | Arrived in Paris. |
|-----------------------------|-------------------------------|----------------------|
| September and October | 105 | 22 |
| November | 83 | 17 |
| December | 49 | 12 |
| January..... | 43 | 3 |
| February..... | 22 | 3 |
| Total | 302 | 57 |

¹ "The Bulletin de la Réunion des Officiers" gives a lower figure.

period of from three to five years.¹ Liberal rewards were given for the restoration of pigeons which had been caught after having lost their way. The sum of 240 francs was paid to a peasant who restored to the Government at Bordeaux a bird captured with its messages intact.

Pigeons began to be collected at Tours from the beginning of October, from which date they were regularly employed as messengers into Paris. It was not, however, till the 4th November, by which time 115 birds had already been used, that the advantages of the pigeon post were opened to the public. On that day the Delegation of Tours issued a decree to this effect: "Considering that since the investment of Paris there has been established, through the agency of the double service of telegraphs and posts, by means of balloons leaving Paris and of messenger pigeons leaving Tours, a special interchange of correspondence destined to supplement between Tours and Paris the ordinary means of communication, which for the time being are interrupted. . . . Every person residing within the Republic is permitted to correspond with Paris by means of the messenger pigeons belonging to the Administration of Telegraphs and Posts, the charge to be 50 centimes per word."²

It was further notified that telegrams for Paris would be received at all the postal telegraph stations of France (not in occupation of the enemy) and transmitted by telegraph or post to the point of departure of the pigeons (Tours). Such telegrams were to be in French and in clear and intelligible language without any signs or conventional figures. The contents to be of a purely private character; information concerning the progress of the war and allusions to politics were forbidden. The maximum number of words was limited to twenty. The arrival of the messages in Paris was not guaranteed. On the 16th November the regulations on the subject were issued from the General Post Office in London, and messages could be sent from any part of the United Kingdom, *via* Tours, into Paris. These arrangements made a considerable impression on the French public, who for the past seven weeks had been debarred from communicating with their friends and relatives in Paris, and within a few days an enormous number of telegrams for the capital arrived at Tours.

In the meantime important progress had been made in the method of transferring telegrams, &c., to the necessarily small despatches that

¹ This decree was as follows: "Whosoever, during the continuation of the war, shall hunt, destroy, or attempt to destroy, outside its pigeon house, by any means whatsoever, such as firearms, catapults, or hawks, a pigeon of any breed whatsoever, shall be liable on conviction to imprisonment for a period of not less than one month or over six months. If it be proved that the accused knew that the pigeon was carrying despatches, or was intended to be used as a messenger, the imprisonment awarded shall be from three years to five years. The person on whose evidence the conviction shall have been obtained shall be entitled to remuneration of not less than 50 francs or more than 100 francs, in accordance with the decision of the Court, and which is to be included in the costs awarded against the person convicted," &c. This decree is dated Bordeaux, 23rd January, 1871.

² This charge was reduced to 20 centimes on 8th January. On 25th November, a system of reply cards was introduced, and a Post Office order service was approved of.

were carried by the pigeons. At first the despatches carried by the birds were written by hand on small pieces of very thin paper and on one side only, a numeric cypher being often used. This is the most simple and primitive method, and was in operation till about the middle of October. It was, however, long and toilsome, and quite unsuited to the transmission of the enormous number of despatches which had to be sent into Paris. Each despatch had to be copied several times, and errors often crept in. It was then suggested by Monsieur Barreswell, an eminent chemist of Tours, to reduce the size of the despatches by photographing them, and thus at the same time secure a large number of copies without risk of errors. The despatches were accordingly first copied in handwriting in large characters, then pasted one under the other upon large sheets of cardboard. These large sheets were then fixed to wooden panels about 2 feet by $3\frac{1}{4}$ feet (65 centimetres by 1 metre), and the panels thus covered with two or three columns of messages were photographed and reduced to $1\frac{1}{2}$ inches by $2\frac{1}{2}$ inches (4 centimetres by 6 centimetres), a reduction of $\frac{1}{300}$ in surface.¹ The photographs were on very thin paper, and on one side only. They were checked under a microscope before being confided to the pigeon.

Amongst the despatches were several cuttings of the "Moniteur" newspaper, which at once demonstrated how much more considerable the reduction would be if all the despatches were printed before being photographed. The next step in advance was therefore to set up the despatches in type and to photograph them on each side of the small paper messages. The first official messages thus printed are dated the 9th November, but the result had been attained some time previously to this, and it was chiefly on account of the facilities this afforded that the pigeon post was open to the public on the 4th November. By that date twenty-two tablets of official despatches had been photographed, twenty copies of each having, on the average, been struck off, and up to the 11th December (the day on which the Delegation moved from Tours to Bordeaux) nearly fifty of these official tablets had been photographed.²

About the middle of November, Monsieur Dagron, a well-known microscopic photographer of Paris, arrived at Tours with two assistants, having been sent out of the French capital by balloon for the purpose of assisting in the photography of the messages. Soon after the transfer of the Delegation to Bordeaux, Monsieur Dagron's new system came into operation. His reduction in surface was much more considerable, and the messages were photographed on a very thin film of collodion. Although necessarily photographed on one side only, each of these films or pellicles contained on an average

¹ Each of these pigeongrams could contain 150 despatches averaging 16 words each. One bird could carry six of these, making 900 messages.

² To these must be added 16 tablets, each containing 6 columns of private messages. These 6 columns contained about 613 messages, averaging 16 words each. As the messages attached to the birds were photographed on both sides, there was a total of 1,226 messages on each pigeongram of about 4 square inches. Monsieur de Lafolaye in his report states that 9,800 private despatches and 43 full sheets of official despatches, all reduced by photography, were sent from Tours into Paris, and that the greater part of them arrived at their destination.

2,500 despatches. One bird could easily carry a dozen of these pellicles, making 30,000 despatches. Sometimes this number was exceeded. For instance, a pigeon which arrived in Paris on the 3rd February carried eighteen pellicles which contained 40,000 messages, most of them private.¹ This was the largest number carried. Each pellicle was sent so as to ensure arrival on several birds, some only three times, others up to thirty-nine times, the average being about twenty.²

The "Bulletin de la Réunion des Officiers" (11th July, 1885) states that "150,000 official despatches and one million of private despatches or notices of money orders were carried by pigeons into Paris.³ These messages if copied in ordinary writing would fill 500 library volumes. The postal orders amounted to 190,000 francs (7,600*l.*)."

The method of attaching the messages to the birds is always of importance, and had not been studied before the siege. At first the paper message written by hand was simply rolled up tight, waxed over, and attached to a feather of the tail. It was soon found that the thread which kept the message in its place cut or damaged the paper, and so in order to protect the despatch from this, and being pecked by the pigeon, from damage by wet, &c., the paper message was inserted in a small goose quill 2 inches long. The tube was then pierced close to its ends with a red-hot steel point so as not to split it, and in the holes thus made, waxed silk threads were inserted to fix it to the strongest feather of the tail.⁴

The birds were stamped on the wing feathers with numbers, the first number indicating the number of birds sent, the second the number of the series of messages, and the third the number of pigeons remaining.

In Paris the Administration of the Posts placed a sentry on each

¹ The greater number of these pellicles contained messages that had been previously sent by other birds into Paris, but the receipt of which had not been acknowledged.

² The weight that can be carried by a pigeon is an important matter. The weight in messages carried by one bird into Paris was always under 1 gram ($15\frac{1}{2}$ grains). In America newspaper reporters attach to one pigeon twelve sheets of very thin manuscript, each sheet being $9\frac{1}{4}$ inches by 7 inches. These sheets are folded and made into a roll nearly 5 inches long. This roll is attached to two tail feathers by means of thin copper wire. The weight of the pigeongram and wire is 96 grams. In England this weight has been considerably exceeded. Pigeons have been used to carry a whole page of a daily newspaper weighing $\frac{3}{4}$ of an ounce (360 grains), tightly rolled up, and hung by a loop around the neck. Birds are regularly employed in this service between Alton and Rotherfield Park, a distance of five miles.

³ The service of post office orders was established on 25th November. Monsieur De Lafollye states in his report to Monsieur Steenackers that, during the siege, 95,581 private telegrams of all sorts, representing a value of 432,524 francs 90 centimes (173,000*l.*), were carried by pigeons into Paris. Of these over 60,000 arrived. Monsieur La Perre de Roo estimated the number of official despatches at 115,000.

⁴ Monsieur Georges Blay was the originator of this idea. At the Museum of the Zoological Gardens at Antwerp there is a stuffed pigeon that belonged to Monsieur Cassiers, and which flew into Paris with messages. The quill is attached to a tail feather.

pigeon loft that had furnished birds for Government use. When a messenger bird arrived the owner was conducted under escort with his pigeon to Monsieur Chassinat, Postmaster-General, who detached the messages.

The first despatches which arrived in Paris were, as we have seen, written by hand.¹ They were read by the naked eye or with the assistance of a microscope. To these succeeded the photographic ones on paper, to decipher which a powerful microscope was essential. When, however, the collodion pellicles began to arrive, a more rapid means of reading them was adopted. Being transparent, they were placed between two pieces of glass put into a species of electric magic lantern, and the writing was thrown in large legible characters on a screen or wall. This was copied by several clerks at once, each taking one column of writing, and in this manner the transcription and sending out of the messages was rapidly accomplished.

In spite of many shortcomings the Paris pigeons performed valuable services. Not the least of these was the conveyance from time to time of news from relatives and friends outside, and the occasional gratification of the intense desire for communication with the rest of the country from which the besieged suffered.

The organization of regular "Military Pigeon Systems" in almost every Continental nation of Europe soon followed the Franco-German War.

The uses to which the birds are put are not however limited to cases where no other methods can be put into practice. In war time the stress of work on telegraph lines and on military signallers will be relieved by this means.

The organization of all foreign military pigeon systems is based upon the same guiding considerations.

The frontier fortresses, especially those that are considered most liable to attack, and a large number of inland towns both open and fortified, are provided with pigeon lofts. An important point in the interior of the country—usually the capital—is selected as a central station with which all other stations are to communicate. There is often also direct communication between fortresses. When the distance separating outlying stations from the central one is considered too great, the connection is ensured by means of intermediate ones. It is also sometimes convenient to resort to this last arrangement in order to reduce the number of birds that must be kept.

† The strategical and other considerations which influence the selection of stations will be best appreciated by following on the accompanying map the description of the French or German system.

The number of birds in each station varies with its position, the

¹ Amongst instances of the satisfactory working of the pigeon post, the following are worthy of record, and are mentioned by Monsieur Steenackers. Being short of chemicals required in his photographic processes, Monsieur Dagron, who could not obtain them in Bordeaux, sent for them by pigeon to a firm of chemists in Paris. The bird was liberated at Poitiers on the 18th January, reached Paris the same day, and on the 24th January the chemicals required were delivered to Monsieur Dagron at Bordeaux, having been sent out of the capital by balloon. The news of the French victory of Coulmiers reached Paris the day after the action.

distances that have to be flown, and the number of directions in which the pigeons have to be trained.

A single section station, that is, where the birds are only intended for use in one direction, should have about 200 birds. 150 birds may be added for each section after the first. Thus, for instance, a station at which birds are trained to fly in three directions should have 500. These are sufficient to ensure communication for six months in case of siege. The calculation is arrived at somewhat in the following manner. Suppose the communication is, on an average, to take place twice a week; then in 6 months (26 weeks) 52 liberations would be necessary. The number of birds liberated on each occasion may be taken to average 3, or a total of 156 for the 52 tosses. Making allowance for various contingencies, it may be laid down as a general rule that the smallest military pigeon station should consist of about 200 birds.

All foreign Governments are however able to modify these figures to the benefit of the exchequer. Under the fostering care of the War Ministers, private pigeon flying clubs have within the past twelve years enormously increased in every part of the Continent of Europe. In Germany there are at the present time some 350 such societies, while in France the number may be estimated at 300. The greater number of these fly their birds in directions fixed by the War Minister, who gives prizes for many of the races. The military authorities can therefore rely upon the services of many thousand privately-trained birds to supplement the work required of the military lofts. In the possession of these pigeons each nation has at its disposal an ever-ready means of general intercommunication, which in time of invasion may be beyond price, and which has been established, and is maintained, at comparatively small cost.

When invasion threatens an interchange of birds takes place: the messenger pigeons are kept confined in their temporary home until their services are required. When a despatch has to be sent to another station, birds belonging to that station are selected, the despatches are attached to them and they are liberated. When properly trained birds are employed, their return to their own loft may be looked upon as almost certain, unless the weather is sufficiently bad to render flying impossible.¹

M. H. J. Lenzen, of Cologne, the chief adviser of the German Government in all matters relating to pigeon communications, makes the following observations on the organization of a system, in his book "*Die Brieftaube*." "It is sufficiently established that pigeons have been used in the service of the god of war to carry news, despatches, &c., to invested places. Such communications might be of the utmost importance, if, for instance, they related to the relief of a fortress, or the timely organization of a sortie. It might, indeed, occur that this method of communicating was the only one left open to the public by which their private correspondence could be maintained, and this circumstance alone not only is sufficient to warrant the establishment of pigeon stations, but should engender a more

¹ The judicious selection of birds is important. Some birds are remarkable for their reliability in bad weather, others for their rapidity under favourable atmospheric conditions.

lively interest for this branch of ornithology, and more affection and care amongst the public at large, but more especially amongst the inhabitants of fortified places. The inhabitants of Paris are well able to appreciate the benefits resulting from direct communication being maintained between an invested place and the outside world. Balloons can indeed secure communication in an outward direction, but the bringing in of news when the telegraph is cut can only be effected by means of messenger pigeons; besides, the direction that a balloon will take can never be depended upon, and the bold *aéronauts* often fall into the hands of the enemy, with their valuable cargo of despatches, &c., in spite of the sympathy of their own countrymen, or they may even be committed to a worse fate. Pigeons which are intended exclusively for ultimate military purposes can be used, as already stated, either for bringing communications—official or private—from outside into a town, or for carrying despatches out. Their services may also be required to carry on correspondence from occupied districts to the seat of Government elsewhere, and *vice versa*. In such a case the birds would, as it were, be secret messengers playing the part of spies.¹ Their work would be of unmistakable importance when an occupied country was either completely shut off from all news, or only received information which had filtered through the enemy, and which was consequently imperfect and unreliable. This latter *rôle* of messenger pigeons may be considered as of equal importance with the first.

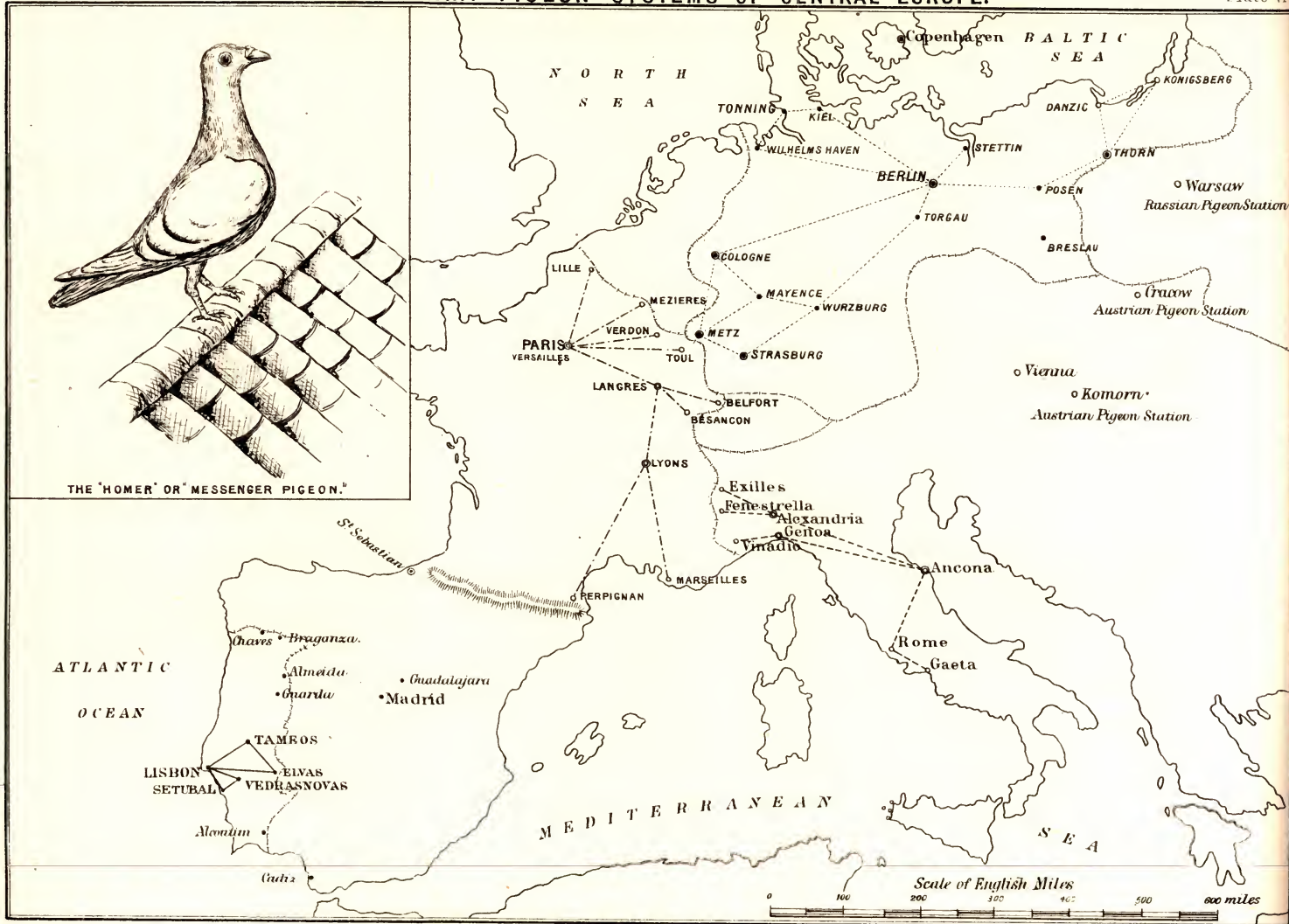
“For the proper carrying out of the scheme it is in the first place necessary that the frontier fortresses and all towns in the interior, whether fortified or not, be furnished with pigeon lofts. It is a question for the careful consideration of the authorities, whether public buildings or private ones are most suited for the positions of lofts in fortresses. The fact that in the case of a siege the public buildings would be the first destroyed, is an argument against placing them there. Suppose a bird with despatches returned and found its home destroyed or gone! It would fly about as a wanderer with the despatches, and that particular part of the system would collapse during the war. In the case of an occupation by an enemy, the lofts and the pigeons would fall into the hands of the enemy. The best course would be to induce or encourage pigeon fanciers in towns (and there are always many to be found) to keep pigeons, and to cultivate the sport of pigeon flying in the same manner as is done in Belgium. In this manner the country would soon be in possession of thousands of pigeons, which could be placed at the disposal of the State in case of national danger, as happened in France. In the Imperial provinces of Alsace and Lorraine the whole task would for the present devolve upon State officials. Furthermore, it would be necessary that all birds be trained, in the interests of the State, in directions fixed by the latter: for example, those of the western frontier places towards the centre of the country, viz., Berlin, and those belonging to Berlin, Magdeburg, and Stettin towards the west. At the outbreak of hostilities the pigeons of the frontier fortresses would be taken into the interior, the best trained and most reliable being sent to the more remote fortresses and open towns, and those with less training to the nearest places. In case of danger threatening any of these places, the birds must be sent further into the interior, but never further than their previous training may warrant. These pigeons will be employed to carry despatches to the commanders of besieged towns, as well as the latest and most reliable news to official persons in the occupied parts of the country. The most important *rôle* will, however, devolve upon those birds that have been taken into the frontier places from the interior of the country. They can, especially if the fighting ground is our own country, carry reports concerning positions, &c., faster than the most speedy mounted messenger, or even than the telegraph. . . . The system must be so organized that the commandants of fortresses and the official persons of towns be furnished with an accurate list of the pigeons that can be placed at their disposal. To avoid mistakes, the pigeons from different towns should be kept in different lofts, or in some other way be kept separate.

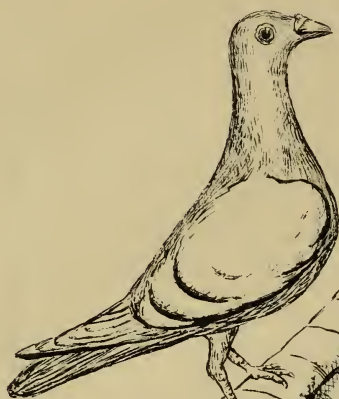
¹ Hence the necessity of searching for pigeon lofts in occupied districts. An invader might not only prevent the enemy from using such lofts, but might employ the birds very much to his own advantage. A series of lofts at intervals along a line of advance would be a most valuable acquisition.

THE MILITARY PIGEON SYSTEMS OF CENTRAL EUROPE.



THE "HOMER" OR "MESSENGER" PIGEON.





THE "HOMER" OR "MESSENGER PIGEON."



○ Warsaw
Russian Pigeon Station

Alcow
Pigeon Station

ation

ATLANTIC
OCEAN



St. Sebastian

Chaves • Braganza.

Almeida

Guarda

• Guad
• Madrid

TAMEOS

LISBON

SETUBAL

ELVAS

VEDRASNOVAS

Alentejo

Alentejo

600 miles

"In the employment of pigeons as military messengers it must be borne in mind that the first consideration is the safe arrival of the message. In view of the obstacles which are met with in the German Empire (such as mountains and forests) the stations should not be too far apart. A distance of 90 to 120 miles may be fixed as a reasonable limit. With such moderate distances the pigeons can be used in unfavourable weather, and when their journey is but 90 miles, they can be liberated in the summer as late as six o'clock in the evening, as they can traverse such a distance in two hours at the outside. All stations should be put into communication with a central station (which in Germany is Berlin), and such a connection can most easily be ensured by means of intermediate stations. A further advantage will result from this arrangement, viz., that in a period varying from one to two years, a perfectly organized post can be established; for young birds in their first season are able to fly 90 miles, while the long journeys of 360 miles can be accomplished by only a portion of the old birds in their third season.

"These considerations have determined the directions of the pigeon races from Berlin, and from Basle, Strasbourg, &c. Special care must be exercised at a station in the identification of birds that are trained in different directions. This can only be ensured by stamping the birds with a number and the name of their route, such as 'Cologne-Metz,' 'Cologne-Berlin,' and entering these particulars in a register kept for the purpose, so that when an exchange of birds takes place preparatory to their employment, they can readily be picked out owing to their previous stamping. Since, as long as the war lasts, the pigeons cannot be expected to return to their station at any certain intervals, it is essential that every bird should signal his arrival. This can be done by means of a trap attached to the entrance of the loft, which is described elsewhere."

A description of the different Military Pigeon Systems of Europe will best illustrate the practical application of the foregoing remarks.

France.

The campaign of 1870-71 showed the French how dangerous it is to neglect any factor that may influence the success of military operations, and that elements of success cannot be improvised, but must be prepared beforehand in all their details if the best results are to be attained.

Prior to the Franco-German War it had not been thought necessary to establish any means of communication that could be made available between an invested place and the rest of the country. It was solely due to the existence of two private pigeon flying societies in Paris that any news from the provinces reached the capital during the siege, and this means could not have been employed but for the assistance of balloons.

The work done by the birds during that critical time, under very unfavourable conditions, all other means of reaching the capital having failed, showed the necessity of organizing a regular service of message pigeons for use in war generally, and particularly as a means of communicating over the heads of the enemy with a besieged fortress.

Immediately after the Franco-German War, Monsieur La Perre de Roo was applied to by several of the Continental Powers for instructions relating to pigeon flying. He was asked to undertake the establishment of a military pigeon system in Russian Poland. Although this offer was not accepted, he appears to have given some assistance to

the Czar's Government in the matter. In the meantime he did not cease to represent to the French military authorities the necessity of establishing military lofts, and in 1872 a Commission was appointed to examine the question. The result of its deliberations was—after an investigation of the merits of the various breeds—to recommend the employment of birds that were to be a cross between the "Pigeon Hirondelle" and the Belgian pigeon. Fortunately no notice was taken of this part of their report. These birds were to be entrusted to the care of the Director of the Jardin d'Acclimatation, and their produce was to stock the military lofts of France.

It was not, however, till the year 1877,¹ by which time many other nations had a regular system of pigeon communication in working order, that any further steps were taken. Monsieur La Perre de Roo states in his book² "*Le Pigeon Messenger*" that he then "prevailed upon the French Government, only after continuous and persevering efforts, to accept as a free gift 420 messenger pigeons of the best Belgian breed . . . and the descendants of these are intended to stock the lofts which are to be established in all the fortresses of France."

Monsieur Geoffrey Saint-Hilaire, Directeur du Jardin d'Acclimatation of Paris, was charged with the care and breeding of the pigeons which were thus to contribute to the national safety. A handsome four-storied pigeon-house, built of brick and iron, was constructed in the gardens, and became the first French military breeding loft. The next loft constructed was that of Mont Valérien.

There are now ten stations well stocked with working pigeons, and all communicating, either directly, or through intermediate transmitting stations, with Paris. All these are on the eastern or south-eastern frontier.

Commencing from the north the military pigeon stations are as follows:—Lille, Mézières, Verdun, Toul, each with about 200 birds, and communicating direct with Paris, the maximum distance being 160 miles.³

No doubt birds are trained to fly between such of these fortresses as are not considered too far apart, but being single section stations with only 200 birds, they are supposed to correspond with one another through Paris.

Belfort and Besançon are single section stations, but being each of them over 200 miles from Paris, they communicate with the capital through Langres.

¹ The "*Bulletin de la Réunion des Officiers*," No. 29, of 18th July, 1885, gives the date as 1878.

² "*Le Pigeon Messenger, ou Guide pour l'élève du Pigeon Voyageur et son application à l'Art Militaire*," by V. La Perre de Roo, Paris. Most foreign military lofts are in the attics of a barrack, and somewhat similar to that of Cologne, which is described in the account of the German pigeon system. Registers containing particulars of every bird are also kept.

³ The lines of flight shown on the map indicate the services to which the birds are destined in time of war. The training of the birds is not, however, confined to the directions and distances shown. The Langres birds, for instance, are trained as far as Marseilles.

Langres is, next to Paris, the most important central station in the country. It is the direct transmitting station for Belfort, Besançon, and Lyons, and should therefore contain 500 birds.

Lyons is a two section transmitting station communicating with Paris through Langres, and receiving from Marseilles and Perpignan, each of which places has a military loft.

In Colonel v. Löbell's "Annual Reports on Changes and Progress in Military Matters in 1884," the following appears:—"Orders have been given for the establishment of central pigeon post stations at Paris and Langres. These are to be formed on a basis for securing the communication for a period of six months between the more important fortresses. Paris is to communicate with Mézières, Verdun, Toul, and Langres, and the latter place also with Belfort, Besançon, and Lyons. Recruits for the working of these establishments are to be taken exclusively from men who before joining have belonged to a pigeon flying society, and they are to be posted to the 1st Regiment of Engineers at Versailles."²

The military budget assigns a credit of 100,000 francs (4,000*l.*) for the annual cost of signalling and pigeon lofts.

In one of our daily papers of the 6th January, 1885, the following telegram appeared from a Paris correspondent:—"The usefulness of carrier pigeons for military purposes is once more demonstrated by the fact that General Campenon has given orders that all the detached and isolated forts on the Alpine frontier be supplied with those birds."

When soldiers are transferred to the reserve, they may take with them a pair of young birds, if they are known to be interested in pigeons. Civilians of approved character may also be given birds if there are any to spare.

In the "Bulletin de la Revue des Officiers" of 18th July, 1885, it is stated that at the grand manœuvres of the 9th Army Corps, private persons lent pigeons which were used as military messengers, and prizes were given for those birds that did the best work.

As in other countries, every effort is made to develop the sport of pigeon flying, and to exercise some control over the directions in which private societies train their birds.³

The Minister of War frequently gives prizes for pigeon races in different directions.

The number of private societies has increased very much in France of late years. At the present time there are about 300 such societies. Allowing 500 birds to each, which is a moderate estimate, there

¹ See "Journal of Royal United Service Institution," vol. xxix, No. CXXXI, of 1885.

² There is a large military loft at Versailles which, with that at Mont Valérien, may be included among the Paris lofts. It will be observed that all the French pigeon stations are here mentioned except those of Lille, Marseilles, and Perpignan. I find that the Lille loft, which is situated in the "Caserne de la Porte de Paris," still exists, but it now contains no pigeons. At Marseilles the loft is in the Fort St. Nicholas, and contains about 300 birds. The pigeons of Perpignan are trained to Marseilles and to Lyons, those of Langres are trained as far as Marseilles.

³ The Fédération du Département de la Seine flew last season from Nuits-sous-Ravières and from Dijon. In the latter *concours*, which was for young birds, 742 pigeons were liberated. The Society "L'Épervier," of Paris, fly their birds from Lyons, 380 miles.

would be 150,000 trained private pigeons in France; probably there are a good many more.

At the suggestion of the Général Directeur du Dépôt des Fortifications, the Minister of War directed Captain Thomas Caldilhac, of the 80th Territorial Regiment, to visit the principal towns of France in the summer of 1884, to report on their resources in trained pigeons and to act as a connecting link between the military lofts and private societies.

In accordance with the Law of the 3rd of July, 1877, the military authorities have the right to requisition messenger pigeons, but it is not specified in what manner these requisitions are to be prepared. In September last the Minister of War reported to the President of the Republic that it was necessary to issue definite instructions relative to such requisitions. M. Grévy consequently directed that once a year, at the time that horses, mules, and other animals are registered, a census is to be made of all messenger pigeons: the lists are to be made out under the orders of the mayors, upon the obligatory declarations of the proprietors of the birds, failing which an official inspection of any loft may be made.

A recent article in a French military paper¹ on their pigeon system concludes thus: "In a word, all dispositions are made, so that, when a new war breaks out, the service of messenger pigeons will not have to be improvised as in 1870. An exchange of correspondence between the central authority, the governors of fortresses and entrenched camps, and the commanders of armies is ensured. In this respect we are quite prepared."

Germany.

The Germans recognized at once the importance of the services that pigeons rendered to their adversaries during the siege of Paris, and were one of the first nations that established military lofts.

In May, 1872, M. Lenzen, of Cologne, whose past experiences with pigeons entitled him to attention on such matters, was charged with the organization of the military pigeon system of Germany. He at once proceeded to Belgium, where he studied all the details connected with the Belgian lofts, and eventually purchased at Brussels and at Antwerp 300 pairs of first-class birds. These were distributed amongst the four first lofts that were constructed, viz., at Berlin, Cologne, Strasbourg, and Metz.² Their number was afterwards increased by further purchases. M. La Perre de la Roo states that at a public sale of *pigeons voyageurs* held at Brussels on the 1st of March, 1874, the majority of the sixty-five birds sold were purchased on behalf of the German Government at an average price of 65 francs per pigeon.

All these Belgian birds were kept as prisoners at the stations to which they were allotted, solely for breeding purposes, and were the stock from which all the military lofts of Germany were supplied.

¹ "Bulletin de la Réunion des Officiers," No. 29, of 18th July, 1885.

² "Die Brieftaube," by H. J. Lenzen, of Cologne, published at Dresden, 1873. Price 15 groschen.

Two pigeon houses were erected in the Zoological Gardens of Berlin; each is capable of containing about 500 birds. They were at first intended only as breeding depôts, and were placed under the supervision of Dr. Bodinus, the Director of the Zoological Gardens.

The pigeon loft at Cologne is in the attic of a barrack, and in 1874 it contained 200 birds.¹ The interior fittings are said to be suitably arranged, and every attention is paid to cleanliness, ventilation, &c. As nearly all the German military lofts are thus situated immediately under the roof of a barrack or other Government building, a further description of that of Cologne may be interesting. The floor space is about 16 yards by 11 yards. The interior is divided by wooden lattices into ten compartments which communicate by sliding doors.² These doors are usually kept closed, but, in order to allow the birds to pass from one compartment to another, there is a small opening at the bottom. This arrangement is very convenient for catching the birds readily—no small consideration when many have to be sent away for a training fly.

The pigeons are fed twice a day on vetches, and their water fountains are cleaned out every second day.

The nest boxes are on the floor against the wall. In each nest box there is a red earthenware nest pan, in the bottom of which are placed a few fine oak shavings.

Round the sides and front of each pair of nest boxes runs a little wooden fence fixing the boundary of the apartments occupied by each pair of birds.

Over each nesting place is a card showing the index number of the cock and of the hen, the date of laying and of hatching, and the number of young ones. Every pigeon is stamped on the wing with his number and the private mark of his loft.

The commandant of the place is responsible for the birds, that they are properly cared for and trained. A non-commissioned officer is in charge, and under him there is a keeper (who receives 4*l.* 10*s.* per month) and two private soldiers. This establishment is for peace time; in war time it would probably have to be doubled.

The accounts are strictly kept, and are signed by the commandant once a month. A register is kept giving a list of the birds, the numbers stamped on them, their age, sex, colour, and any distinguishing marks.

Another register gives the different places from which each bird has flown, with notes on their rapidity and reliability. It contains complete information on the capabilities of every bird.

The next fortresses that received attention were those at the eastern extremity of the Empire, viz., Königsberg, Thorn, and Posen, all near the Russian frontier.

Other pigeon stations have from time to time been added until the German military pigeon system has become by far the most extensive and complete of Europe.

¹ "Le Pigeon Messenger," by V. La Perre de Roo, p. 112.

² This description of the Cologne loft is taken from "Le Pigeon Messenger." It applies generally to French and German military lofts.

The western fortresses of Cologne, Metz, and Strasbourg each contain at the present moment about 400 trained pigeons, but it is intended to increase the number to 600. Mayence and Würzburg are also well stocked with birds.

Cologne communicates direct with Berlin, a fly of 300 miles, and is a transmitting station for Metz, and perhaps for Mayence. Strasbourg and Metz are both in communication with Berlin through Würzburg. There is an important pigeon establishment at Torgau on the Elbe, which fortress acts as an intermediate transmitting station from some of the western fortresses.

The whole of the northern coast is studded with pigeon stations, which are under the Minister of Marine. They are to be found at Wilhelmshavn, Tønning, Kiel, Stettin, Danzig, and Königsberg. There is intercommunication between all of these, and they are all in direct or indirect communication with Berlin.

Experiments have recently been made by the naval authorities in homing pigeons on board men-of-war, so that messages may be sent to the ship from the shore. It is said that the birds experience no difficulty in recognizing their own ship amongst a number of others. Such a method of communication may at times be of value, but its application is evidently a good deal restricted.

Thorn is looked upon as a central station of importance, and is said to be prepared for the accommodation of 1,000 pigeons. It is in direct communication with Posen, Königsberg, Danzig, and Berlin. Breslau is also in communication with Berlin by pigeon.

The training is not confined to the lines of flight I have indicated, which are often insufficient to test the qualities of the birds. For instance, the Königsberg pigeons are trained as far as Torgau.¹ Those that will fly that distance are hardy resolute birds that may be depended upon as messengers from shorter distances, even in bad weather.

The stations under the Minister of Marine do not all belong to the Government. That at Danzig was established by contracting with a private individual, the possessor of a large loft, to keep a specified number of birds in training.²

The military birds are employed as messengers whenever opportunity occurs. In the manœuvres which take place annually in the neighbourhood of Cologne, the garrison of the place are kept constantly informed of the progress of the operations by this means, and pigeons are also sent direct from the field of operations to Berlin with reports.

The annual credit in the military budget for pigeons and signalling was increased in 1884 from 900*l.* to 1,700*l.*

¹ Königsberg to Torgau is about 390 miles. The training table for this journey is given in the "Militär Wochenblatt," p. 999, of 1884. The distances between the training stages are very similar to those generally adopted in England. The birds are never liberated later than 5 A.M.

² I understand, from information obtained from local sources, that the Danzig contractor has recently given up his pigeons, and that there is now only one amateur in that town who keeps homing pigeons, his loft containing about fifty birds. At Stettin the birds are also private property.

Such resources as I have described might be considered sufficient to ensure a regular service of pigeon posts throughout the country in case of invasion. The Government have, however, also at their disposal the services of a large number of private lofts scattered over the whole Empire. Since the Franco-German War pigeon flying has continuously and rapidly developed,¹ until it may now be said to be a national pastime. The number of private societies is estimated at 350, the country enclosed by the western fortresses being most favoured in this respect. The federation of pigeon flying clubs of the outer Rhine numbers seventy societies. The United Federation of Cologne and its environs have issued their training table for 1886, and during the coming summer will send their birds as far as Vienna, about 470 miles.

The Emperor is an active supporter of the sport, and gives gold and other medals every year for races over long distances. Military Officers of high rank attend the meetings of the principal societies. The Minister of War assists, as in other countries, by offering money prizes at some of the *concours*.

With a view to reduce the ravages committed on pigeons by hawks, the Government offered, in 1885, rewards to gamekeepers and others for the heads of any birds of prey.

Austria.

In Austria the application of pigeon flying to military purposes has been very gradual.² The first private society is said to have been established in 1873, and the first military one two years later, at Komorn. A second military station was established in 1882 at Cracow. As far as I can learn there are no others in Austria.

Very complete instructions "*für die Brieftauben stationen*" were issued by the General Staff, in 1883.

Private societies are evidently relied on to a great extent to supplement the work of the Government birds, and prizes are given annually for races to Vienna and other places. Besides this the Government give, free of cost, the wood required for the erection of a pigeon loft to such Officers and Government servants who will undertake to keep and train the birds, with a view to their use as messengers in case of war.

¹ In 1875 the "Colombia" Society of Cologne had 157 members. In that year it organized nineteen pigeon races. Since that time it has continued to increase in importance, and is now one of the leading German clubs of Germany. At a general meeting of the Rhine societies held at Elberfeld on the 25th October last, seventy-four different societies were represented. The following clubs will take part in the Vienna Concours of 1886:—Union-Cologne, Club-Cologne, Cenobia-Deutz, Fauna-Elberfeld, Columbia-Elberfeld, Brieftaube-Solingen, Brieftaubenpost-Solingen, Concordia-Bonn, and the Brieftaubenzüchter-Verein.

² This account of the Austrian pigeon lofts is chiefly taken from an article by Lieutenant Mandry, of the Austrian Field Artillery, which appeared in the "*Organ der Militär Wissenschaftlichen Vereine*," No. 39, of 1884. See also "*Die Brieftaube im Deinst des Krieges*," by Lieutenant E. von Scheure, published in "*Streffleur's Militärische Zeitschrift*," July, 1883, Vienna.

At the end of the breeding season civilians can buy young birds just out of the nest at 50 kreutzers each (one shilling). The railway lines also assist by taking persons at reduced fares who accompany baskets of birds sent by train for liberation.

The Austrian military authorities appear to appreciate the usefulness of pigeons as messengers in mountainous countries, where the electric telegraph might not be able to keep pace with the movements of troops, or where detachments had no other method of communication. It is now a question of establishing pigeon stations at certain places on the mountainous frontier, viz., at Franzenfeste for the Tyrol, at Karlsburg for Transylvania, at Serajevo for Bosnia, and at Mostar for Herzegovina, the object being to establish rapid communication by pigeons between the fortresses of the frontier and the passes of those mountainous regions.

In the experiments that the Austrians have made the following results have been attained:—

Vienna to Komorn, 144 kilometres, in $2\frac{1}{2}$ hours. From Olmutz to Komorn, 206 kilometres, in 3 hours and 20 minutes. From Lemmaring to Vienna, 84 kilometres, in 1 hour and 20 minutes. The average rate of flight for these short journeys was therefore 1 kilometre per minute.¹

Russia.

Russia appears to have been the first European country that adopted a military pigeon system.

In April, 1871, the Russian Government proposed, as already stated, to M. La Perre de Roo that he should undertake the organization of a pigeon system in Russian Poland. Although the offer was not accepted, several pigeon stations were shortly afterwards established, and a regular service of pigeon posts was organized. The first lofts were at St. Petersburg, Krasnoë-Solo, Moscow, Kieff, Varsovie, Warsaw, and Norvo-Georgewsk.

In parts of the Empire, however, the results were not satisfactory, and in 1883 some of the military lofts were abolished. A correspondent in St. Petersburg, who has made enquiries for me on the subject, writes, "The expense of the military lofts was very great, and for some years the results were almost *nil*, for several reasons—(1.) The native pigeons are no good for long journeys, and the imported ones die in great numbers, from the severity of the climate. (2.) The appearance of the Russian country and landscape is so uniform and monotonous, that the birds had no landmarks to guide them, and consequently were very often lost (all the villages in Russia are wonderfully alike, and the steppes also)."

These are some of the reasons assigned for the abolition of the pigeon stations. They are, however, not worth discussing, for it is known that homing pigeons can stand Arctic cold with impunity, and

¹ The Komorn birds have done some good work, but the Cracow loft has not been a success. Small lofts have been established at Olmutz, Riva, and Gardasel, by the private enterprise of Officers, who received birds from the Government on condition that the experiments were to be conducted at their own expense.

the monotonous aspect of the country is not a sufficient cause for the collapse of the pigeon communications.

The military authorities also assert that the organization was faulty, and left too much in the hands of amateurs.

"It is now intended to reorganize on a really efficient footing, and the affair has been placed in the hands of a Commission of Officers of the Engineers. As yet, however, nothing has actually been done, and the idea is to proceed tentatively at first. With this object, new stations are to be established at some of the western fortresses on the Vistula."

From Warsaw I learn that a regular pigeon service has been kept up for some years between several fortresses, and that there are lofts at Warsaw, Norvo-Georgewsk, Ivangorod, and Brest-Litovski, fortresses not very far apart. As general intercommunication is aimed at, there should be 500 birds at each of these stations.

The contemplated reorganization is confirmed in a telegram from a Russian correspondent of the "Times," which appeared in that paper in November last.

The sum annually voted for the maintenance of pigeon communications is said to have been 2,000*l*.

Lieutenant Mandry, of the Austrian Artillery, states in his paper, which has already been referred to, that experiments have recently been made to test the use of pigeons in tactical operations, where a turning force or detachment may be without communication with the main body. Such a case might readily occur through the nature of the country not admitting of the sufficiently rapid laying of a telegraph wire, or through the removal by the enemy of part of the wire which, under such circumstances, is usually dangerously exposed. In such a case the birds from the detachment would return to their loft, which should be the one nearest to the headquarters.¹ The messages would then be transmitted to the General Commanding by telegraph. These tactical experiments are said to have been carried out under General Stroukow during the last great manœuvres. "According to the report of the General, the experiments succeeded, and this method of communicating will very likely be introduced amongst the irregular cavalry for exploring service in front of the Army.

"It appears that in Afghanistan, and in their other far distant possessions where the telegraph can never be relied on to work with regularity, correspondence by pigeons may be the best means of securing the maintenance of communications."²

In some of the large towns, such as Kieff, Warsaw, and Moscow, there are a few amateurs who breed and fly pigeons.

Italy.

In Italy there is an extensive military pigeon system which is now beginning to work satisfactorily.

¹ This suggests a question as to the length of time necessary for the establishment of a loft. From experiments that have been made, it is found that if suitable birds are available, they can be trained up to 50 miles within three weeks of the opening of the loft.

² "Bulletin de la Réunion des Officiers," 18th July, 1885.

The establishment of military lofts dates, I believe, from the beginning of 1872.

The stations on the north-western frontier are at Exilles, Fenestrella, and Vinadio. There are also military lofts at Alexandria, Genoa, and Bologna.

On the western coast Gaeta and Rome, the latter a large central station, are both furnished with pigeons.

Ancona on the eastern coast is an important central station; the loft is situated on high ground in the Villary Barrack. A subaltern Officer is in charge. The internal arrangements appear to be complete in all particulars, and a record is kept of everything that takes place amongst the pigeons.

According to the "Bulletin de la Réunion des Officiers," it is intended eventually "to increase the number of pigeons at Ancona to 2,000." This strength has, however, not yet been reached. In July, 1884, there were about 300 birds, of which 151 were old trained pigeons, and the remainder untried young ones.¹ The birds are divided into three sections, and are trained to Rome, to Genoa, and to Turin.

The north-western stations train their pigeons eastwards towards Ancona.

The lofts on the coast also train their birds out to sea, with a view to their employment as messengers from cruisers off the coast.

The "Bulletin de la Réunion des Officiers"² recently stated that "generally speaking, either on account of want of proper care, on account of climate, or on account of mismanagement, the breeding at Ancona has not been attended with success; neither have the results obtained in other respects been satisfactory. "For some years past the training experiments that have been made have not succeeded. This may be accounted for by the ill-chosen positions of intermediate stations, which may be either too far apart, or not in a straight line with the extreme points. The experiments are, nevertheless, still continued, and an improvement in the breed of bird employed, and in the instructions given, may be expected."

On 4th of June, 1884, experiments were carried out at Turin—on the occasion of the Zootechnical Exhibition—with Italian messenger pigeons carrying despatches. The birds were divided into groups.

The first group consisted of eight messengers for Ancona (315 miles distant), and started at 8.20 A.M. The next two groups were Bologna³ birds, and started at 9 A.M. and 9.15 A.M. respectively. The fourth group was composed of six birds for Alexandria (50 miles distant). The fifth group was six birds for Exilles (35 miles distant); and the sixth and last lot were liberated at 10.30 A.M. for Fenestrella (32 miles distant).

The results of these experiments were published at the time in a Belgian newspaper⁴ devoted to such matters. Of the eight Ancona

¹ These figures and other particulars relating to the Ancona loft, are taken from the newspaper "L'Ordine," of Ancona, of 4th June and 27th July, 1884.

² No. 29, of 18th July, 1885.

³ Turin to Bologna is 190 miles.

⁴ "L'Épervier, 6th July, 1884.

birds, two reached their home at 6.20 P.M. the same day, having taken ten hours to accomplish their journey of 315 miles, and four others arrived in the course of the next day.¹ It is not recorded whether the remaining two birds eventually turned up at their loft.

There are several private pigeon societies in Italy, but I am not able to give much information as to the work they have done.

The Modena Flying Club race from Ancona and from Rome.²

Spain.

Owing to the apparent liability of civil wars in Spain, the establishment of military pigeon stations would appear desirable in that country.

In 1876 the Minister of Marine decided to establish pigeon lofts at various coastguard stations. The idea was to employ the birds to communicate between the different stations, and also between the shore and naval cruisers which in war time would be employed to intercept the enemy's ships, and in peace time to stop smuggling. "Le Pigeon Messenger" states that stations were established, and the experiments that were made were perfectly successful.

In 1879 the Minister of War ordered the erection of a pigeon loft at the Military School of Guadalajara.

Madrid, St. Sebastian, and Cadiz were subsequently furnished with pigeons.

The military pigeon service is under the orders of the Director of Engineers.³

Portugal.

The military pigeon system of Portugal dates from the year 1876. M. La Perre de Roo, after some correspondence with the Portuguese War Minister, had presented to the Government in the previous year several pairs of stock birds, which were kept as prisoners in a suitable pigeon loft at Lisbon, and became the progenitors of many of the working pigeons of the military lofts. New blood was subsequently introduced by the purchase of twenty pairs of birds from Antwerp and Liège. Under the able direction of Captain A. C. Bon de Sousa, who is an enthusiastic and experienced pigeon flyer, the various stations at which the lofts were to be established and the lines of flight were decided upon.

The original plan has not yet been fully carried out. There are now five lofts which have been in regular working order since 1881. These are Lisbon, Setubal, Tameos, Vedras Novas, and Elvas. To complete the system it is intended to establish a central loft at Oporto, and single section lofts at the frontier fortresses of Chaves,

¹ The result of the Turin-Ancona fly is taken from "L'Ordine," already referred to.

² In July, 1884, this club had a race from Ancona for young birds. Forty pigeons competed.

³ "Telegraphia Militar," by Captain D. Carlos Banur, published in Barcelona, 1884, devotes one chapter to messenger pigeons.

Bragança, Almeida, Guarda, and Alcoutim. Lisbon is, of course, the headquarters, and the central station.

The Lisbon lofts are constructed on the most recent and approved systems, and being under the personal supervision of Colonel A. C. Bon de Sousa, now Director of Telegraphs and of Military Pigeons, are models of cleanliness and order.¹ They contain at the present time 400 birds which are trained to fly from Elvas (120 miles), from Vedras Novas (45 miles, almost in the same line), from Tameos (83 miles), and also from the north, and from Setubal (18 miles south).

At Setubal there are 100 birds trained to fly from Lisbon.

Tameos is a strategical point and entrenched camp of great importance, at the junction of the Zezere and Tagus, the hills forming strong positions covering Lisbon from an enemy's advance down the valley of either river. Here there are 150 birds trained from Elvas (60 miles), and from Lisbon (83 miles). Tameos is the School of Military Engineering.

At Vedras Novas (45 miles due east of Lisbon), where is the School of Artillery, there are 250 birds trained to Setubal and Lisbon.

At the important frontier fortress of Elvas (some 10 miles from the Spanish fortress of Badajoz) there are 300 birds trained from Lisbon (120 miles), from Tameos (60 miles), and also from Chaves (210 miles).

As the whole length of Portugal is but 350 miles, there will be no difficulty, especially considering the central positions of these five pigeon stations, in securing communication with Lisbon from any part of the country.

The nature of the country and climate is not, however, favourable to pigeon flying. The country which the birds have to cross is intersected by several mountain ranges, the Sierra d'Estrella being in some places over 6,000 feet high, abounding in birds of prey, chiefly large vultures and hawks, and in winter covered with snow. Colonel Bon de Sousa states, in his book "*Serviço dos Pombos-Correios*," that the pigeons always fly down the passes along which they have been trained, and that very few are lost when in proper flying condition.

The climate presents considerable variations in the north and south provinces, the latter being very hot in summer, and consequently trying to the pigeons.

A velocity of 1,000 metres per minute has been attained, but the average rate of flight is 800 metres.

The introduction of military lofts has resulted, as is usually the case, in the general spread of pigeon flying throughout the country. I have been assured by a Portuguese gentleman that about eighteen months ago four pigeons belonging to Lisbon were liberated at Southampton, each with a message attached; two of the birds reached home, 900 miles from their starting point, but only one of them still carried its message.

Colonel Bon de Sousa has told me that on the 1st July, 1881, four pigeons belonging to a Pigeon Flying Society of Paris were liberated

¹ This information was kindly given me by a gentleman who visited the Lisbon lofts about twelve months ago.

at Lisbon, and that they all reached Paris on the 5th July, having flown nearly 900 miles.¹

Denmark.

In Denmark there are no pigeons which are the property of the Government. There is, however, a pigeon club at Copenhagen, and others exist in the provinces. There is a monthly paper called "Brevduen," devoted entirely to the sport. Races are organized throughout the summer months, and the Danish War Office has recognized the possible utility of the pigeons by granting money prizes for some of the races.

It is not within the scope of this lecture to enter into particulars relating to the management of a loft of homing pigeons, or the method of training them. There are several English books devoted to this very interesting and important part of the subject.²

I will content myself with observing that the loft should be kept thoroughly clean, should not be damp, should be well lighted, and not overcrowded. Our English lofts are usually specially built. On the Continent the gable ends and attics of existing buildings are generally utilized. 200 birds is the maximum number that should be allowed in a single loft. If there are more, they must be homed in two or more lofts, which should be some distance apart.³ The training consists in sending the birds in baskets (or paniers) away from home and liberating them, first at short distances, and then at longer ones until the goal is reached. Young birds in their first season, when about five months old, may be trained to fly home from a place 150 miles away. In their second season this distance should not be much increased, but in their third year they may be sent fully 400 miles.

Many men fail to achieve success with their pigeons and give up their birds in disgust. In a letter by "Voyageur," which appeared in "The Field" of December, 1872, the following observation occurs: "A man may have the best strain in the world, and if he does not understand the minutiae of breeding, training, feeding, and general management, he may sit expecting his birds home till he gets such a crick in his neck that he vows he won't have anything more to do with the job. They simply don't come under those circumstances."

¹ The Americans are fond of flying "for distance record." They have accomplished journeys of over 900 miles. The greatest distance covered by a homing pigeon in America is reported in "The Homing Pigeon," New York, 26th Sept., 1885. The bird flew from Montgomery, Ala., to Fall River, Mass., the "air line" being 1,040 miles. The time taken was 20 days.

² "The Homing or Carrier Pigeon: Its History, General Management, and Method of Training," by W. B. Tegetmeier, F.Z.S. "The Homing Pigeon Fanciers' Guide," by J. W. Logan; price 2s. 6d., from "The Stockkeeper" Office, 140, Fleet Street. "The Homing Pigeon," by J. L. Burgess, Latton, Cricklade, Wilts; price 1s. of the author.

³ One hundred birds require a loft with a floor space of about 100 superficial square feet. When the pigeons are prisoners they require fully twice that amount of space.

It is therefore essential to exercise judgment in the selection of persons placed in charge of lofts, to make sure that they are by nature fitted for such duties, that they will take an interest in the breeding and work of the birds under their charge, and that they have been properly instructed by practical apprenticeship to their employment. There is no difficulty in doing this, and without these precautions failure at first is almost certain.¹

To appreciate the perfection to which pigeon flying may be brought, a visit to Belgium is essential.

Belgium is the ancestral home of the European messenger pigeon. The Belgians were the pioneers of long-distance pigeon flying, which they originated more than sixty years ago.² Their devotion to the sport saved the *pigeon voyageur* from oblivion, when the introduction of steam and electricity threatened its universal extinction. "In that country pigeon races, or *concours*, still constitute the great national pastime, which is supported by munificent gifts from His Majesty the King of the Belgians and the Comte de Flandres, subsidies from the great cities, and subscriptions, amounting to many thousands of pounds annually by those interested in the pursuit."

There are nearly 2,000 flying clubs in the country, which own between them an enormous number of birds. The favourite direction for training is through Paris to the south-western extremity of France and even into Spain. In 1885 in a *concours* from Douai, 1,928 birds were liberated, while in the national *concours* of Bayonne (565 miles from Brussels), there were 1,155 competing birds.³

A large number of pigeons are also trained eastwards through Germany, and some westward to London. In 1884 the Belgians had races from Dover, London, and Sandhurst, in 1885 from Dover and from London: the average number of competitors was 500. In the Dover race of 1884, 1,000 birds started, of which some 300 were lost, owing to the thick weather in the Channel.

Reference has already been made to the important connection that exists between the work of private pigeon flying societies and that of Government pigeon establishments. It is therefore interesting to examine our own resources in trained pigeons, which have been developed by private enterprise, and which are capable of being placed at public disposal.

During the past few years very considerable progress has been made in this country in this respect, and at the present time a large

¹ It will have been observed that the first establishment of Government lofts has in many cases been a failure.

² The first Belgian fly of any importance was in 1818, when about 100 miles was accomplished. In 1820 a bird flew from Paris to Liège, about 200 miles. In 1823 the first race from London to Belgium is said to have taken place. At that time Liège was the chief centre of pigeon flying. The first Pigeon Society of Brussels was established about 1826.

³ In the Belgian National Race from Lamothe in 1880 there were 3,637 competing birds, half of which arrived home on the day of liberation. Paris to Brussels, 170 miles, has been flown in two hours 20 minutes. There is a Belgian Society for the protection of pigeons. Rewards are offered for the conviction of persons who shoot or otherwise destroy pigeons. A price is set on the head of every bird of prey.

and still increasing number of persons take part in the sport of pigeon flying. The number of birds—old and young—put into training during the past season may be estimated at about 9,000. The great majority of these are trained through the medium of pigeon flying societies. The number of these societies in the United Kingdom is about forty—mostly in England. In the metropolis there are four: the chief of these is the London Columbarian Society, which races its old birds from Cherbourg, from Granville, from Rennes, from Napoléon Vendée, and from Bordeaux, and its young birds from Templecombe, Chard, and Exmouth. A conductor is invariably employed—as is the custom with all the more important societies—to take charge of the birds during their transit to their destinations, to attend to their wants and to liberate them, weather permitting, at the appointed time.

The result of the London Columbarian Society's races during the past season may be summarized as follows: 526 old birds were put into training and marked for the Continental races. In the Cherbourg race 226 pigeons were liberated, the velocity of the winner, which had flown 130 miles, being 1,437 yards per minute, and each of the first 41 birds attaining a velocity of over 1,000 yards. In the Granville race 126 birds were liberated; the velocities were somewhat higher than in the preceding case, while the average distance was nearly 200 miles. In the Rennes race 122 birds competed; but owing to bad weather during their flight, about half of them were lost; the eleven first prizes were nevertheless won with velocities of over 1,000 yards, with an average distance of 231 miles. The result of the race from Napoléon Vendée, 345 miles from London, and therefore 100 miles beyond the previous toss at Rennes, was, under the somewhat unusual attending circumstances, very remarkable. The birds left London on the 29th of June, for liberation on the 2nd July; but owing to bad weather, they were detained at Napoléon Vendée till the 7th, when a start was effected. They had, therefore, for eight clear days immediately preceding their flight of nearly 350 miles, been confined in a training panier. The first four birds, nevertheless, flew home at a rate of over 1,000 yards per minute. The Bordeaux race was not a success. Twelve birds started, but only two returned to England, and these were several days on the road. For the young bird races, 1,281 squeakers (young birds just out of the nest) were marked. The majority of these were, however, lost or taken off the road before they had done 100 miles. For the Templecombe race 240 birds competed (distance, 105 miles from London). For the Exmouth race, distance 160 miles, there were 53 competitors.

Of provincial societies, there are also several that do excellent work. Amongst these may be classed the "United Counties Flying Club," of which Mr. J. W. Logan is president; the "Manchester Flying Club;" the "Preston and Northern Counties Homing Society;" the "Southern Counties Flying Club," and a few others. These four clubs flew between them a total of over 1,000 old birds in their early races during last season, and a somewhat less number of young birds in their later races.

The "United Counties" is not only engaged in training and racing their birds, but offer prizes for open competition on payment of a fixed entrance fee. Pigeons taking part in the open races are divided into four groups, according to the districts in which their lofts are situated, so as to ensure some uniformity of distance. Their races are from Winchester, Ventnor, Cherbourg, Granville, Rennes, and La Rochelle with old birds, and shorter distances for young ones. Their last race from La Rochelle is worthy of record on account of the distance, over 450 miles, flown by some of the competing birds. Thirty-four birds were liberated at La Rochelle at 4.41 A.M. on July 18th, and the three first prizes were carried off by birds that reached their English homes before 9.15 A.M. on the following morning; but of the thirty-four starters, seventeen—or just one-half—were lost.

The Manchester Flying Club train their old birds as far as Vannes, 407 miles, and their young ones up to Swindon, 127 miles. They marked last season about 1,000 old birds and 600 young birds for racing. The Preston and Northern Counties Society fly from Rennes, 400 miles, with old birds: and from Chippenham, 157 miles, with young birds.

The birds of these two last-named clubs must always cross on their homeward journey the smoke-covered districts in which ironworks and cotton manufactories abound; but this does not appear to affect their velocities, which are often excellent.

The practical result of English fondness for the sport is that at the present moment there are in this country a considerable number of excellent and highly trained pigeons suitable for use as messengers in case of necessity. It is not easy to estimate with accuracy what that number is. Perhaps it is about 2,000, of which only 400 have flown over 200 miles, the remaining 1,600 having been trained from 100 to 200 miles.

Figures such as these, if even approximately correct, illustrate in a striking manner the proportion of loss which may attend the training of pigeons in England, for out of some 9,000 birds with which our English pigeon-flying campaigns of 1885 were begun, there are left but 2,000 reliable working birds. Of the remainder, 1,000 may be classed as insufficiently tested, and 6,000 as having been lost in training.¹

In the limited time at my disposal, I cannot enter fully into the probable causes of so many losses. There can be little doubt, however, that as our experiences become extended and the quality of our birds improves, our percentage of losses will decrease.

Our variable climate, our liability to mists and fogs, will nevertheless always be responsible for more or less heavy losses in training, and we can hardly expect to do as good work with pigeons in this country as our Continental neighbours do abroad.

The chief point in connection with English pigeon flying to which I

¹ These statistics have been compiled with the assistance of returns kindly furnished by some of the leading societies. It must be borne in mind that a large number of birds that accomplished distances of over 200 miles were afterwards lost at 300 miles or perhaps more.

would draw attention is that we have in this country a widespread fondness for the sport which is capable of large and rapid development.¹

As most foreign standard works on pigeon flying allude to the employment of pigeons by the Trinity House authorities, as the first official recognition in this country of the utility of these birds as messengers, and further as the attempt was not crowned with success, it is desirable that some allusion be made to it. The general idea was to obtain communication with light-ships by this means. The experiments were first commenced in 1876, and were continued without interruption up to March, 1885. The upper story of a disused lighthouse at Harwich was fitted up as a pigeon loft, and some suitable old birds were installed there as prisoners. The first year was spent in breeding from these, and in training the young ones to fly more especially across the sea. In the summer of 1877 the birds (then about twelve months old) were sent off in relays to the "Cork" and "Sunk" light-vessels, distant respectively about 5 and 12 miles from Harwich, where they were kept in roomy cages specially constructed for the purpose. Every time the Harwich sailing tender went to sea a fresh basket of birds was sent to the light-vessels, from which, when the weather was not too bad, a bird or two would be daily released. Many birds were from time to time lost, and the pigeon loft was reinforced by the addition of young birds (squeakers) purchased in Belgium.

After a trial of eight years² the attempt was abandoned, as the Board were convinced that for the purpose of the Trinity House pigeons were useless. They could only be depended upon to return home in fair weather. "In gales of wind or in snowy weather, which would be the only times when the light-vessels might be desirous of calling immediate succour from the shore for vessels in distress, the birds if sent up were invariably lost or refused to leave the ship." The pigeons therefore—100 in number—were sold by auction in London on the 3rd March, 1885. If the birds were intended for use in bad weather only, it is obvious the experiments were doomed to failure from the first.

It is not for me to venture an opinion on the desirability of establishing Government pigeon lofts in England.

I may, however, be permitted to indicate some of the considerations which bear upon the question, and which should not be lost sight of in discussing it. We enjoy some undoubted advantages through our insular position, and, as a rule, we are not given to underestimate them. These advantages do not, however, extend to the safety of our communications in case of war. In this respect we are in a far worse position than any other European nation. A Continental country could not be prevented from communicating with the rest of the world and be thrown entirely upon her own internal resources, except in the very improbable case of being at war with all surrounding neighbours. An invasion would affect her communications only to a limited extent.

With us the case is different. Our telegraphic communications with the external world might be severed without an invasion. Our submarine cables might be cut by an enemy who had never come within sight of our island.

I am not able to state what arrangements have been made by our naval authorities for the protection of the many cables³ which radiate

¹ One of the chief obstacles to the development of pigeon racing in England is the heavy expense of training, that is, the high railway rates charged for live birds.

² These particulars were kindly furnished by the Trinity House authorities.

³ The number of cables between the United Kingdom and places abroad is twenty-nine. Seven cables cross from Ireland to England and Scotland.

from these shores to all parts of the globe. It would obviously be a difficult task for our home or Channel fleets to watch and protect them all; while the great speed of war-ships of the present day would render hostile demonstrations of this nature by fast cruisers and other ships by no means difficult.

In such an emergency, pigeons afford a means of maintaining direct, cheap, and speedy communication with the Continent.

An organization of this nature existed half a century ago, when a regular interchange of correspondence took place between London and Cologne,¹ *viâ* Antwerp, and between London and Paris by means of messenger pigeons.²

A further use of pigeons applicable to our insular position, and on which the Italians appear to place some reliance, lies in their employment as messengers from an observation ship, or fast cruiser, told off to watch the movements of an enemy's fleet. By having a suitable number of birds on board, every movement of the enemy could, in moderate weather, be reported in the day time to a military station on shore. An illustration of the services that can be rendered by pigeons in such cases is afforded by Boyton's paddling cruise across the Channel in May, 1875. The South-Eastern Railway Company's steamer "Prince Ernest" accompanied the swimmer in his passage. Twelve trained pigeons belonging to Mr. T. G. Ledger, of Folkestone, were put on board. These birds were liberated at regular intervals, and carried reports to Folkestone, whence the messages were telegraphed to London. In this manner the London press was able to publish periodically on that day accounts of Boyton's progress.³

It has already been shown that, in case of actual invasion, pigeons probably afford the *only* means of preserving a fairly efficient system of corresponding.

If the view taken by a writer of a series of articles on "Volunteer Coast Defence" is to be accepted, it would appear that our coast frontier is in a "dangerously defenceless state."⁴ He says: "We have many commercial ports, small harbours, open roadsteads, and inlets abounding on our coast which we have not the means of properly protecting, and for which we have no systematic scheme of coast defence."

In any case, in the presence of the large and formidable Continental navies, it is safest to regard the sea which surrounds us—and on which many build their convictions of insular safety—as a vast plain over which an enemy can easily move and approach us at any point and from any direction. We spend money freely on our forts and

¹ M. Lenzen is responsible for this statement.

² In 1836 there were three pigeon lofts at Dover, containing between them some 600 birds. They were all employed in this Continental service. Pigeons were also kept about this time at Folkestone for a similar purpose. The proprietors were stockbrokers and newspaper reporters.

³ Pigeons were used in a similar manner in the late American International Yacht Race between the "Puritan" and the "Genesta."

⁴ See "Army and Navy Gazette," 5th December, 1885, *et seq.*

coast defences, on the guns we put into them and on the men who garrison them, but we have no means of communicating with any of them in case they are invested.

In conclusion, I beg to be permitted to tender my best thanks to my many correspondents abroad, who, at considerable trouble to themselves, have kindly obtained for me information on the pigeon systems of the countries in which they are resident. Without their help, the descriptions of the foreign military systems would have been far more incomplete than they are.

The CHAIRMAN: I hope that this instructive and interesting lecture will be followed by information from other persons who have given their attention to this art; and if General Hassard, of the Royal Engineers, is here, who I believe has come at considerable trouble, and has great knowledge of this subject, I will ask him to open the discussion.

Major-General HASSARD, C.B.: I am here, Sir Beauchamp Walker, but I am afraid I have very little to say after the exhaustive manner in which Captain Allatt has brought the subject before you. I could say, of course, a great deal that he could also say about details, but that I think you do not want to hear. There is one thing which perhaps will amuse you, that these birds are not always employed for good purposes; sometimes they are employed for bad. About six weeks ago I heard they were used in South Africa—descendants of birds that I took there—to smuggle diamonds from Kimberley to Cape Colony. I quite agree with Captain Allatt in what he has said concerning the utility of the birds, but I do not think it necessary to say anything more.¹

Mr. TEGETMEIER: Mr. Chairman, ladies, and gentlemen, I can only say I have heard with very great pleasure the very exhaustive and complete lecture of Captain Allatt. I may speak, perhaps, with some little authority on the matters, inasmuch as some ten years ago I myself brought the subject before the Engineering College at Chatham, and I have been very much interested in the subject of homing pigeons ever since my boyhood. With regard to the practicability of using these birds I am perfectly satisfied. In 1872 I got my friends at Brussels to send over 200 pigeons for a race from the Crystal Palace to Brussels. The pigeons were started at 12 o'clock (a very late hour of the day, considering the distance that they had to travel, and that they fly so much better earlier in the morning), and at the same time I went to the telegraph station, and telegraphed to my friend, a very well-known columbophile in Brussels, that the birds had started, but the pigeons reached Brussels first, and informed him that the telegram was coming. On that occasion I wrote a letter to the "Times," calling the attention of the military authorities to what I thought would be a great advantage of pigeon messages from armed cruisers watching an enemy's fleet, in case the submarine telegraph was broken. That letter was reprinted by my friend Mr. Gould, the eminent naturalist, in his work on "The Birds of Europe." To show that this was not an exceptional flight to Brussels, I may say it was repeated the next year, and two years afterwards it was repeated twice from the Alexandra Park. In all these cases the flights were accomplished with very great success. The return flights from Brussels to England were not as good, because our birds in England at that time had not been trained for long distances. I differ a little from my friend Captain Allatt, in believing that the utility of the birds will not be found in flying 300 or 400 miles, but in short stages of 40, 50, or 100 miles. In flying long distances of 300 or 400 miles, a very large number of birds are lost, whereas in the shorter distances under 100 miles practically very few of the birds are lost. I have always found in endeavouring to establish communication by pigeons, the great difficulty has been to get suitable men to take charge of them. Unless the man is what you may term a born pigeon

¹ In 1852—53 I employed pigeons to carry official messages between Guernsey and Alderney with success.

fancier, he is of very little use. An ordinary man, who may even be a lover of birds, or an obedient soldier, is not the man that will answer; you must have a man who is used to the birds, and really takes a very vital interest in them. That is a point about which I have found some difficulty. At the request of the Trinity House, I endeavoured to establish a pigeon service from the light-ships situated off Harwich, after the loss of a large German vessel on the sands some eight or ten years ago. The conditions were very severe on the birds, inasmuch as they had to be kept for a month on the light-ship, and the agitation of the vessel during the whole time when the weather was rough must have knocked about the birds in a rather dangerous manner. Still they saved some ships, and I believe some lives. Since then telegraphic communication has been established, and the pigeons have been discontinued. I may mention perhaps another case, which illustrates the value of these birds, under certain conditions, even over the electric telegraph. Originally the ships going out to India touched at Point de Galle, at the south of Ceylon, and communications were sent up by pigeons to Colombo, the seat of Government, and the news of the capture of Sebastopol was conveyed by pigeons to Colombo, and a salute was fired there celebrating the victory, solely on the authority of the intelligence brought by the pigeons. The editor and proprietor of the paper there told me of the anxiety with which the military men at Colombo came to his office in order to wait for the news brought 70 miles by the birds, where the electric telegraph was established and committed to the hands of the natives, and he gave up his pigeons, but after six months' experience he wrote to me and asked me to send him some more birds, because the pigeons were not only better, but would convey more intelligence, and at a greater rate than he could receive it by the electric telegraph as worked by the natives. These are a few illustrations of the practical use of pigeons, in corroboration of those mentioned by Captain Allatt. Captain Allatt said he thought it was quite impossible to make pigeons go anywhere except to one home. Now I am inclined to differ from him in this way. I think it is possible, that is to say, it is not out of the range of possibility, to make them follow a movable home. I recollect on one occasion being in one of the squares of London, and seeing a singularly formed handbarrow, drawn by a man and woman. It attracted my attention, as there were some pigeons in it; the man opened the barrow, and the pigeons flew out, and when he blew a little trumpet they returned. He sent them away again, and then moved the vehicle round the square down the adjacent streets; the trumpet was blown again, and back flew the birds. I do not know how far this idea could be practically worked out, but a correspondent in "The Field" some years since really drew out a plan by which he thought movable homes might be conveyed with armies, and pigeons might be trained to follow the army, and return to these small movable homes. I merely mention this. I do not think it so important as the fact of training them to fixed places, but still it might be possible. As to their utility in warfare, and the feasibility of their employment, the details which Captain Allatt has given of what took place at the Siege of Paris, with all of which I am perfectly acquainted, and know to be perfectly accurate, show how very feasible the plan is, and how exceedingly useful it may become.

Captain W. S. J. HORNBY, R.N.: Sir Beauchamp Walker, my lords, ladies, and gentlemen, I think we must all be very much obliged to Captain Allatt for the very interesting lecture he has given us. Like my friend Mr. Tegetmeier, who I am delighted to see here this afternoon, I am one of those who have always from boyhood days taken a very great interest in pigeons, and when I have not been at sea I have always had birds. Before I went to sea I had a pigeon which did very good work. I flew it a distance of 25 miles: in these days of course it would be considered a very short distance, but in the year 1849 it was not so, and I then flew that little bird 25 miles. Another reason why I am glad that this lecture has been given here to-day is that now we have an opportunity of this subject being brought to the notice not only of the press but also of the military and naval authorities. I am quite aware that Mr. Tegetmeier years and years ago wrote on this subject, but the Government of this country, it appears to me, generally allows all new ideas, inventions, or discoveries to be conducted by private enterprise. As an illustration of the dawdling nature of the Government, I may say that when chain cables were first invented they were used—I won't say for ages—but certainly for years by merchant

ships before they were introduced into the Navy. It was the same thing with regard to iron tanks for holding water; water-casks were still used to a great extent when I went to sea, although the first private shipping firms had long discarded them. It was the same thing with reference to steel hawsers. The Admiralty are about the last to take up any useful invention of this sort. And so it seems to me with regard to pigeons. The great military Powers of Europe, as you have heard from the lecturer this afternoon, have all adopted the system of military pigeon-lofts, but it has been left in England to the private enterprise of individuals. Amongst those individuals I am glad to see Mr. Tegetmeier and Mr. John W. Logan are present. Mr. Tegetmeier was the first to introduce into this country the Antwerp or Belgian voyageur. I remember talking with him in 1870, before the siege of Paris, and he then told me just what *might* occur. When I was at Paris in 1884, I met the gentleman who has been mentioned by the lecturer, M. La Perre de Roo, and he told me that he was in Paris and had seen these high military authorities, and, as the lecturer said, they simply laughed at him when he told them he had pigeons which would be of some use to the country in case Paris was completely invested. Mr. Logan is the gentleman who instituted pigeon races for long-distance flying in this country, and he has flown further distances I believe than anyone—at all events until the London Columbarian Society came into the field. I had some splendid birds from Mr. Tegetmeier myself in 1870, but latterly, in consequence of living in London, I have not been able to do much in the way of joining Mr. Logan's club, which has its headquarters at Market Harboro', although I have taken great interest in, and have been present at much pigeon flying of all sorts. With regard to the distances flown by pigeons, perhaps I might say a word. Young birds five, six, seven, and eight weeks old will no doubt do 100 to 150 miles, but I do not think it is desirable that young birds should be taxed so far, and thus worked beyond their strength. I should not care myself to let a young bird do more at the outside than 100 miles during the first year. At the same time, with regard to the old birds, although it is a very grand thing to have birds that will do 400 or 500 miles, I think those are only extreme cases, and distances of 200 miles are to my mind quite sufficient to test the birds. For instance, from Brussels to London will be about 200 miles, and from Boulogne about 100 miles, and Cherbourg about 140 miles, and I do not think we want to get a single bird further than that—at least so far as military operations in this country are concerned. In the old times, and for years before telegraphs, when the stockbrokers used to depend upon pigeons for early information from foreign bourses, they had three or four relays. The pigeons used to come over the Channel to Dover or Folkestone, then from there to Redhill, from Redhill to Blackheath, and then into London. In this way they had three or four changes; but I fancy they did the distance as quickly as at present, and the time taken in changing the despatches from pigeon to pigeon was so very short, that they really gained in that way, as the birds, thoroughly knowing their road, were seldom lost. Mr. Tegetmeier touched upon pigeons being attached to floating objects. I can say in my own experience I have kept pigeons on board men-of-war on the Pacific Station and in the Mediterranean Fleet—the blue-jackets have often pigeons in the tops. But we never tried flying them; they never deserted their own ships, but they always knew one ship from the other.

Admiral Sir ERASMUS OMMANNEY: How many years would a pigeon work?

Captain HORNBY: Up to ten years. I should put the prime of the bird at from five to six years. With regard to some of the distances done, and the time in which they have done it, very much depends upon the state of the atmosphere, the clearness of the sky, and whether the birds have a fair wind or not; so that really the criterion of a bird flying at a certain speed is very delusive. I find that the United Counties Flying Club, of which Mr. John Logan is president, and his brother secretary, in 1884 did from Cherbourg, about 200 miles, at a speed of 796 yards a minute—but it was very stormy weather this side of Channel; from Granville, 267 miles, at an average of 830 yards a minute; from Rennes, 309 miles, at a speed of 806 yards a minute; from Nantes, 333 miles, at a speed of 795 yards a minute. Then they had a race from La Rochelle, 444 miles, on a very bad day, blowing hard; the first bird did not turn up for two days; but I believe they had another similar race from La Rochelle this (1885) year, and the winning bird arrived the

next morning. Those are very great distances for birds. On the Continent—especially in Belgium—they have great advantages, because the country is much flatter, the atmosphere is much clearer, and they have not the great disadvantage of having to come over the sea. Coming from Cherbourg or any of the towns of the South of France, our birds have to fly over 60 or 70 miles of water, where they can get no object to guide their sight at all, and if it is not very clear weather they have a very hard job to find their way—how they do manage goodness knows. Perhaps one of the most extraordinary races on record is one mentioned in a work written by Mr. Tegetmeier. The race was from Rome to various cities in Belgium; the distance being 900 miles. The first bird was ten days getting home. Of course for particular purposes in the way of military operations that would be useless, it was more to show what birds *will* do. In that case out of the 900 miles the birds had to fly, 500 miles was over ground which they had never been over before. In that case the birds would have to fly either over the mountains, or to go round by Nice, and so by Paris home—which they probably did. Out of the 200 pigeons liberated at Rome there were only 20 which arrived at their homes in Belgium. That shows what birds are capable of doing. Nothing will daunt them as long as they have strength and are not caught or shot. The most interesting point of late years with regard to pigeons has been the part that they played at the siege of Paris; but I think if the birds had been better birds and better trained—that is, if the Frenchmen had understood how to work birds like our English people do—they might have obtained better results. I will take any English working man, and he will know something about pigeons, but at that time (1870) in France nobody knew or cared much about them. Frenchmen, as a rule, do not care much about them, and there was only one pigeon club in Paris which at all went in for training and racing. Those birds were only trained in a northerly direction—and there were very few of them—and, as has been said by the lecturer, the authorities did not believe in them. The consequence was that Paris was eventually isolated and unable to hold communication with the armies in the provinces. I think military men will see that if the Parisians had had four or five hundred trained pigeons, there is no doubt they could have had easy and rapid communication with the Army of the Rhine, with the army that got shut up in Sedan, and with the army in Metz, and I leave it to military authorities to decide whether, if communication could have been opened up between Marshal MacMahon, Marshal Bazaine, and the General Commanding in Paris, there might not have been a different complexion put upon the war. With regard to a military pigeon system being taken up and adopted by the English Government, I think it is hardly possible at present to induce our Government to establish pigeon stations round this country. I do not advocate it; but I do think they might give subsidies to well-known and celebrated clubs, whereby prizes could be offered, and so the great expense of training would be in some degree met. One of the greatest difficulties of training pigeons is the expense of having suitable persons to take charge of them, and the heavy railway fares. I have done my own work for the last two years altogether by myself, and I have found it a great expense. By the formation of clubs a great deal of individual expense is avoided, but not to a sufficient extent, and working men who have a few birds are not able to find the money for entrance-fees and things of that sort. I think therefore that the Government might assist by giving prizes to some of the chief towns and the garrison towns, so that people might have an inducement to keep a few birds on hand, and then there would always be the certainty of having birds ready in case they were wanted.

MR. LOGAN: I came this afternoon not to address any remarks to the gentlemen I see around me, but to try and gain a little information for myself; but as you have been kind enough to ask me to say a few words I will do so. I hope that Captain Allatt will pardon me for not agreeing with him in all that he says. I am very fond of the sport of pigeon-flying, and have been all my life. I may say I am a most ardent pigeon fancier, and, as a rule, I would vote with my party on pigeon-flying through thick and thin, but in this case I am afraid I cannot, because I prefer my country first. I should like to warn the military authorities of this country not to place too much reliance upon pigeons. On the Continent they have gloriously fine, clear weather day after day, month after month, the year round,

Here what have we? Nine months out of the twelve weather totally unfit for any bird or the best bird to fly in. I have been in town for the last fortnight, and during that fortnight if you had got together the best 300 birds in London (and there are some very good ones here) on very many days during that time, and had taken them 200 miles in a direction in which they had not been trained, you would perhaps not have seen one again for days or even a week, given a continuation of the same weather, for the weather has been totally unfit for pigeon-flying. I should have rather liked to have heard from Mr. Allatt some small details as to how he proposed to work the birds. I have read several letters on this subject, and have followed Mr. Tegetmeier and his movable loft; but God help old England, Mr. Tegetmeier, the day she relied upon your movable loft! I should like to say that, taking the ordinary weather round our coasts at any time of the year, with the exception of three months in the very finest weather, birds could not come into England if you took them 60 miles away. Therefore I say to those who are going to study the subject, let them bear in mind this one most important thing, and that is, that given the very best birds in the world, they cannot return home on a thick day when they cannot see, and I leave you to guess how many of those thick days we get in jolly old England. No, my friends, let us keep command of the sea round the coast, and do not let our telegraph-wires be cut, we shall not then want cruisers dodging about the Channel letting off birds here and there. Let us keep command of the sea, and then we shall not want any assistance from such unreliable messengers as homing pigeons.

MR. TEGETMEIER: May I rise to correct a statement of my friend Mr. Logan? The proposal of movable lofts was not mine, and I merely threw it out as something that had been suggested. With regard to Mr. Logan's statement that the birds would not fly in winter, would you permit me to remind him that the birds sent out from Paris were 6 on November 2; 6 on November 4; 6, November 6; 32 on the 12th; 34 on the 18th; 24 on the 24th; and so on till the end of the month? Three pigeons were sent out on December 7; 18 on December 11; 15 on December 10, and continued during the very worst of the winter months, and of the 300 birds that were sent from Paris 73 returned with information. If only one pigeon out of 300 had come back, the intelligence would have been worth to the Parisians all the expense that was incurred by them.

MR. F. A. KEY (President of the London Columbarian Society): I agree, Sir, with what has fallen from the gentlemen who have addressed this meeting, with the exception, perhaps, of the statement made by Captain Hornby, who has told us that from 100 to 150 miles is quite far enough to fly birds. Should unfortunately the necessity arise for us to have to avail ourselves of the services of pigeons for military purposes, and those pigeons whose lofts were in London, and happened to be liberated at a greater distance than 100 miles, say from off the south-west or westerly coast, the chances would be very few would see their homes again. I can only state that we have on occasion flown pigeons from Penzance, a distance of 270 miles, and from the Scilly Islands, a distance of 300 miles, to London. With reference to a subsidy from the Government, I may say that the London Columbarian Society does not fly for any money prizes, which it has been urged might give rise to gambling—we simply fly for honour, to see if we can get a first, second, third, or fourth class certificate, and then there is an end of it, so far as we are concerned. I am sure, therefore, that if any gentlemen present who have it in their power would recommend to the Government how highly prized a subsidy would be in a pecuniary sense to the societies all over the kingdom, I am sure it would be heartily appreciated. It has been urged that the objection to the use of pigeons by the military authorities is that in bad weather they will not always find their way home. That I do not take to be an objection, simply because, in the case for instance of pigeons taken in cruisers some distance from the coast, it does not follow that because they may not find their way to their own loft in London, they would not find their way to another loft elsewhere. As a rule, whenever a pigeon fancier finds a stray pigeon in his loft, he looks on its wings to see if there is a name on them, so that if he be an honest fancier, he may return it to the right owner. The pigeon will undoubtedly find its way to some cote or the other, and of course if pigeons were employed in time of war for intelligence purposes, every pigeon fancier would

be on the *qui vive*. There would be the more reason to examine every strange bird, to see if it was the bearer of information that would be of assistance to the authorities.

Captain HORNBY: May I say one word with regard to what has been said about birds not being able to return in foggy weather? Any experienced person will know that the weather is not always in a condition for the birds to fly in. I had a bird of my own last year, which I sent over from Folkestone to Boulogne, to be thrown up there, but when it arrived there the weather was so thick that it was decided not to liberate it. It rested in the basket till the next morning, and then, the weather being tolerably clear on the French side, the bird was thrown up. My friend in Folkestone wrote and told me the weather was so bad there that he did not think I should ever see the bird again. When the steamer came back to Folkestone in the afternoon, the weather was so thick on this side of the Channel that the gun had to be fired at Folkestone to show the steamer the position, and it was delayed a considerable time before it could get in. But in the meantime my bird had flown right over the fog (as we supposed), and long before the gun was fired at Folkestone my bird had arrived safely in his loft in London. This shows that the birds do try to get home thick or fine weather. This bird must have come right over the fog which was floating about in the Channel on our side, although not on the French. As I am probably the only Officer who has ever visited the inside of a foreign military pigeon loft, I will just mention that I had an introduction to the French military authorities at Paris, and being an Officer, was courteously allowed to see one of their military pigeon lofts in Paris. The pigeons were kept in the attics of the barracks, and were as fine a lot of birds as I have ever seen. In this particular loft they had 500 birds, which were trained to fly from the different frontier fortified towns. That loft is only one of a number. I thought I would mention this as a practical fact connected with the subject of the lecture.

General HASSARD, C.B.: When Captain Wharton (I think he is now the Hydrographer of the Admiralty) left Sheerness some few years ago, he had a surveying vessel called the "Fawn." He called upon me, knowing I knew a good deal about pigeons, and I think he called also on Mr. Tegetmeier. He said that some time ago, when they were surveying, they were very much delayed, sometimes for want of an angle, or other information, and he wanted to know if he could not take the birds on board, and let them go out in the boats, so that the information he wanted could be sent to him by the pigeons. Well, he was fitted out with baskets—we got them made at Sheerness—to go under the thwarts of the boat, in order that the pigeons might be taken out surveying. Sometimes the boats did not come back at night, and he was very anxious to know about them. The arrival of a pigeon might explain the reason. Singularly enough he came round the Cape when I was at Capetown, and I asked him about these pigeons. He said they flew fairly well, but as far as his object of getting information from the surveying boats was concerned they were a failure. This was not on account of insufficiency of intellect in the pigeons, but the fact was Jack had made them so tame on board, that they could not get them to fly away from the boats, and when he turned them out they would sit on his shoulders. They could not frighten them away to the ship. If the attempt is again made to use them in marine surveys, Jack must be ordered not to make them so tame, then I think, if the ship is not too far off, they might be used for this purpose. Captain Hornby stated that pigeons know their own ships. Admiral Luard told me that if any ships went away suddenly from harbour, and that the pigeons were absent, on the return of that ship they came back again to their own vessel. This shows that they even recognize individual ships.

Major GUNTER: I have had no practical experience in the training of pigeons, but I have for some time taken great interest in this question, and from what I have seen and read of their employment, I should like to support what Captain Allatt has said in regard to the great utility of pigeons for military purposes. I think they might be found especially useful in our Indian frontier warfare, and that pigeon centres might be established at stations along the frontier, so that in our many little wars, which take us into country where telegraph lines cannot well be laid down, trained pigeons might be taken with the force, and communication thus

rapidly established. When Sir Donald Stewart marched in 1880 from Kandahar towards Ghuznee and Kabul, to join hands with Sir Frederick Roberts, we were practically without communication of any kind until after reaching Ghuznee we were able to heliograph to the troops coming to meet us. The Kandahar force had been established in and about Kandahar for more than a year, and pigeons could have been trained during that period. When General Burrows moved on to intercept Ayoo Khan, the news of the latter's immediate approach could have been conveyed in about an hour to Kandahar from Maiwand. The weather in India is generally favourable to pigeon-flying. Pigeons were in ancient times a good deal used in the East as means of communication, and I have no doubt that the messenger pigeon would be found of especial use for military purposes in India as supplementary to other means of communication.

Mr. TEGETMEIER: Some five or six years ago I sent out through the India Office 50 pigeons to India, but I do not know whose hands they were put into, or what use was made of them. I sent them out at the request of the India Office.

Colonel BAYLIS: May I ask what time it takes for a pigeon to acquire a home that it will return to? I think it is a very interesting question.

Major GUNTER: Somebody asked as to the time of flight. I have a note here in regard to the Ceylon Pigeon Post mentioned by Mr. Tegetmeier. They took from one and a half to two hours flying from the Point de Galle to Colombo. During exceptionally heavy monsoon weather they took longer—but arrived. In fact this pigeon post was continuous and regular.

Captain ALLATT: Some allusion has been made to pigeons flying to homes that are movable. You will find in my lecture—although I did not read it because time was running short—an account of some experiments which have been made in Germany in that direction. I should, however, not like to place much reliance upon the services of birds that were intended to fly back to a home which had moved any considerable distance whilst they were on their journey. Their return I should say would be uncertain. I know that birds have been trained, not to “fetch and carry,” but to fly from one place to another, and back again. It has been done in this way: the bird has been homed in one loft where after a time it has been fed as usual, but water has been withheld. It was then taken to another loft where only water was given it. It was then allowed to fly back to its old loft. When this process had been repeated a few times the bird would fly backwards and forwards between the two lofts for food or water. This can never be but an unreliable method of communicating, as food or water might be obtained in the country during a journey. With reference to the distance separating military lofts, I quite agree with what Mr. Tegetmeier has said, viz., that from 90 to 100 miles is sufficient.¹ The advantage of having military pigeon stations at such intervals would be, in the first place, young birds of four or five months old could be trained to fly 90 miles without a very large percentage of loss. If the pigeon lofts were further apart it would be necessary to employ older birds—birds of a couple of seasons. There is no advantage in training young birds over long distances. My own experience—which is not very great—and the experience of others whom I have consulted in the matter, leads me to believe that the best birds we fly in their second season are those which have been trained somewhere about 30 miles in their first year. If you train young birds 150 or 160 miles in their first season, I believe their constitution becomes affected, and they are not so good in their second year. I believe, as a general rule, that will be found to hold good. As to birds kept for stockbroking purposes, in 1836 there were 600 pigeons in three pigeon-lofts at Dover kept by stockbrokers for the purpose of communicating with Paris and Antwerp. I know the houses where the lofts were, and have frequently conversed with an old man who had charge of one of them. They had stations near Arras, at Boulogne, Dover, Canterbury, and two or three other intermediate stations up to London. In those days, you must remember, one great difficulty was to train the birds—because they had to be sent by coach. These birds were used by stockbrokers who received their information in London a long time before others who had not the advantage of pigeons, and in that way they were able to transact business much to their own

¹ This is the distance given by M. Lenzen.

advantage. With reference to the long-distance races alluded to, I think it will be found that the distance from Rome to Brussels is a good deal less than 900 miles.¹ I believe the longest-distance record we have, has been flown in America, where 1,040 miles has been done by one pigeon—and the Americans have several birds that have done over 900 miles. There is a newspaper called the "Homing Pigeon," published in America, which I occasionally get, and from which I get these particulars. Mr. Logan said he should hardly consider birds reliable to fly 100 miles on a bad day in a direction in which they had not been trained. The simple answer is they should not be sent in a direction in which they had not been trained. I should train them first, and then only send them in the direction in which they had been trained. Of course if the weather is very bad, birds are bound to be lost, but some always come home, even on very bad days. As to the time it takes to home a pigeon properly, you must get him as a young bird—about four or five weeks old. You keep him in his loft three or four days, and then let him out. The best time is in the evening. After he is fed he is not inclined to fly; he goes outside his loft, looks about, and comes in again. The next day you let him out, and he is sure to come back again. You never can rely upon homing old birds which have been trained in other countries or on other lines of flight; you never can depend upon homing them in any other place but the one in which they first saw the outside of their loft. I have now and again succeeded in homing old-trained birds. I have a bird which flew from Tours to Brussels—300 miles. He is homed at Sandhurst, and he flies out with the other birds, but that is exceptional. As a rule with trained birds, directly they are let out—even if they have been kept as prisoners two, three, or four years—the first time they are let out, away they go looking for their old home. As an instance, I may mention a case that occurred a few weeks ago. A gentleman had kept a bird confined from five to six years at Redhill, and then thinking it was pretty safe, he let him out. The bird went straight away, and he saw it no more. With reference to the length of time that pigeons will sustain their flight, that of course depends chiefly upon the weather. If the weather be favourable, birds will fly 250 miles without alighting. Over that distance it is generally found that the bird has alighted. This may be detected by looking at his feet and the end of his tail-feathers, which will generally indicate whether the bird has landed anywhere between the time of departure and the time of arrival.

The CHAIRMAN: Ladies and gentlemen, I think a very warm vote of thanks is due to Captain Allatt, not only for having furnished us with an extremely valuable lecture on this subject—which I am inclined to look upon as one of considerable importance—but also as having attracted to our theatre gentlemen who have furnished us with still further information. I have always thought that one of the great advantages of the lectures in this Institution is that the discussions attract gentlemen of all classes of life and of varying opinions, who afford us a very excellent addition to the lectures to which we listen. I must confess to knowing nothing about pigeons, excepting that as an article of food I look upon a pigeon as the meanest food that exists. I perfectly remember from my earliest youth I have always been told that a person who ate a pigeon daily for a month would die at the end of it. I do not know whether that meant a month of 28, 30, or 31 days, but such was always the saying, and, excepting in pie—and there the pigeon has been almost ousted by the young rook—I really do not know in what shape pigeon is fit to be eaten, excepting as a cutlet, and then he is very good: the breast just taken off and cooked as a cutlet eats very well. But I must say when I dine out, and find the only game to be had is pigeon, I make a very hearty dinner beforehand, because I do not much care about the end of the feast. I beg that you will allow me to tender, in the name of the present assembly, our very warm thanks to Captain Allatt, and also to those gentlemen who have so kindly favoured us with remarks.

¹ The distance in a straight line is 720 miles.

Friday, February 5, 1886.

MAJOR-GENERAL SIR ANDREW CLARKE, G.C.M.G., C.B., C.I.E.,
Inspector-General of Fortifications, &c., in the Chair.

ON SUBMARINE BOATS.

By THORSTEN NORDENFELT, Esq.

WHEN the Council of this Institution did me the honour to call upon me to read this lecture, I felt considerable hesitation how to deal with the subject, as it covers too large a ground for one single lecture. I, however, came to the conclusion that I should best meet the wishes of the members by stating what has been done, and what is being done in this direction, and by giving my views upon what can and what cannot be done by submarine boats in practical warfare; and not to encumber the lecture with too many technical and scientific details, as these would form sufficient material for a separate lecture, which might perhaps more properly belong to the Naval Architects or other scientific institutions.

First, I beg to be allowed to say that I cannot admit, as I have heard stated, that there is anything especially cruel or horrible in the idea of a submarine boat.

War altogether is cruel and horrible, and causes an enormous amount of pain and suffering, but any invention which may tend to shorten a war, or to protect commerce and private property during war, will really diminish this suffering on the whole.

It has been said that there is something especially cruel in the fact that a submarine boat advances in secrecy, and without giving the opponents any chance of firing at it or of protecting themselves against it, but the whole tendency of war has moved in this direction, ever since the days of old, when Hector and Achilles advanced in front of their respective followers, and spent half-an-hour in abusing their adversary's parents and ancestors before they commenced to fight.

What can be more cruel than the leaden bullet which kills at the distance of a mile when you cannot see either the rifle or the man who fires the bullet; or the shell from a 100-ton gun, which may

cause the destruction of a large vessel six miles from shore if it strikes a vital part?

A fish torpedo is a secret missile, and hitherto every naval architect has done his utmost to render it more effective by increasing the speed of the surface torpedo-boats, and thereby make the attack more sudden and unexpected. If I have gone a step further by carrying the torpedo under water up to the point where it can be most effectually discharged, I have made the attack still more sudden and unexpected, but I have at the same time increased the chances of safety for the crew of the torpedo carrier, who in a surface boat are as much exposed as was the light brigade which charged the Balaclava batteries.

The same secrecy or suddenness of attack is permitted ashore; the whole object of strategy is to keep the enemy ignorant or to mislead him as to the movements of an army until the General can deliver a sudden attack by overwhelming forces, and an ambush is nothing but the development of this idea. Sir Andrew Clarke, and other leaders of modern engineering, are now averse to the heavy granite structures which offered a long range target for the enemy's ship, and do their utmost to assimilate the appearance of the batteries to the surrounding country by covering the earth with turf and shrubs; the latest development of which idea is the revival in another shape of Moncrieff mountings by the present Inspector-General of Fortifications in the disappearing gun platform which can be laid against the enemy's ship before the heavy gun suddenly appears out of a peaceful looking ploughed field, discharges its deadly projectile, and again disappears through its trap-door, after having shown itself for a few seconds only.

The principal *raison d'être* of a submarine boat is the suddenness of its attack, and if the attack by torpedoes fired from a submarine boat is more effective than that fired from a surface boat, while the crew is less exposed in the submarine boat, it should find its place amongst the armaments of nations.

The submarine boat is and must always remain essentially a means of defence, and when ports can be defended by submarine boats against bombardments and blockades, even if their action were cruel and horrible, the enemy can best avoid any suffering from their action by refraining from attacking the ports of my country, and then my object would be gained.

The idea of submarine boats is very old. The first record I have found of such a boat is the one which was built by David Bushnell during the American War of Independence.

As early as 1776 this boat was used in an attempt to blow up the English man-of-war the "Eagle;" it, however, failed to do so, and there was a strong suspicion, when the man who undertook the task returned to shore the next morning to claim his reward, that he had never seriously tried, but had passed his night comfortably floating on the water.

Washington, in a letter to Jefferson, in 1785, wrote that it was difficult to find men to undertake the risk of making an attack with

this entirely novel invention in consequence of the difficulty of driving and steering it under water, and the uncertainty of attaining its object.

It was not a comfortable boat, its appearance was that of two turtle-backs screwed together, its crew consisted of only one man, who had air enough for thirty minutes, during which time he had to work by hand the screw which propelled the boat, to pump in and out water by hand for descending to desired depths, and to let go 200 lbs. of ballast for rapidly rising to the surface.

The explosive mine contained 150 lbs. of powder, and was to be screwed into the bottom of the enemy's wooden vessel, after which the charge was exploded by clockwork started by the operator when he retired after having fixed his mine.

This of course sounds very crude, still it contained the germs of nearly all the subsequent unsuccessful attempts to make efficient submarine boats.

Next came Robert Fulton, who tried a submarine boat, also propelled by hand, at Brest, in France, where he remained under water for one hour. As the French Government did not adopt his invention, Fulton went in 1784 to England, where Pitt showed considerable interest in his invention, and some very costly experiments were carried out with his submarine boat as well as with his surface torpedoes, which, however, did not lead to any results.

Fulton then returned to his native land, and the United States Government paid for serious attempts to develop his inventions, without success, however, as far as the submarine boat was concerned.

In 1821, an Englishman, Johnson, built a submarine boat on the Thames, which turned out a failure altogether. I have not been able to find any details of the construction of this boat.

Nothing more was heard of submarine boats until 1851, when a Bavarian, by name of Bauer, constructed a submarine boat for the Holsteiners to use against the Danish war-ships which blockaded Kiel. It was not, however, completed in time, and did not give satisfaction when ready. It was propelled by hand, with pumps for changing the specific gravity of the boat, and a special apparatus with watertight gloves, for fixing under the vessel a mine which was to be fired by electricity. At the final trial the boat sank right enough, but could not be raised.

About the same time a Frenchman called *Alexandr * had some trials in New York Harbour with a submarine boat, but it does not seem to have offered any new feature.

At the time of the Crimean War, the Russians, according to subsequent reports in the English press, used a sort of submarine mine which could be moved a certain distance, but which could hardly be called a boat. A full description was given of this in the "Illustrated London News" for the 23rd June, 1855.

Two explosions were said to have taken place under H.M.S. "Merlin," off Cronstadt, the shocks of which caused considerable alarm on board, without, however, doing much damage. This

movable mine was probably some modification of Dr. Payerne's movable diving bell which was tried in 1847 in Paris and Cherbourg, and which was described in "La Presse," in 1847.

During the War of Secession in the United States, the attention of both sides was drawn to submarine boats. The Northern Government, anxious to destroy the Southern ironclad "Merrimac," are stated to have agreed to pay a Frenchman 10,000*l.* for his invention of a submarine boat, with a further sum of 5,000*l.* for each successful attack. The first-named sum seems to have been paid, but the boat was never successfully built.

The Confederate authorities carried the point further, and actually sank one or two Northern vessels by means of such boats. The first boat, made of thin iron plates, was 35 feet long, 3 feet beam, and 5 feet deep; she was propelled by hand by eight men, who worked a longitudinal shaft, which, by gearing, gave a considerable number of revolutions to her screw. Her greatest speed was 4 knots in smooth water; the air-space in her was said to be sufficient for the eight men and the captain for two hours. Two side rudders were used for sinking and raising the boat when in motion, and its depth was supposed to be regulated by the incline given to these rudders; when not moving, the boat was sunk and raised by taking in and pumping out water. The boat was meant to tow a mine which would explode on contact with the enemy's vessel; but when this boat sank the Federal vessel "Housatonic," in February, 1864, she used a spar torpedo; the great danger of this was proved by her going down, with her crew of nine men, together with the ship she destroyed. The Federal flagship "Harvest Moon," Admiral Dahlgren, was also sunk by a mine; but though the Continental press at the time stated that this mine was carried by a submarine boat, other reports say that it was a fixed ground mine.

At the Paris Exhibition, 1867, another submarine boat was shown, designed by Admiral Bourgois and Mr. Brune. She was 26 feet long and 9 feet deep; her screw, worked by four men, was said to give her 4 knots speed; she also descended and ascended by means of water being taken in and pumped out. Secret experiments are said to have been made with this boat by the French Government.

The Russian Government has for years spent large sums of money upon the perfection of submarine boats. In 1868 a boat, built of the so-called "Alexandrofsky" type, was run on the Neva, off Mr. Winans' railway works; she was towed by a steam launch and descended successfully several times, but did not seem to satisfy the Russian naval authorities.

About five years ago another submarine boat, made on what is called the "Bjevalsky" system, was tried in St. Petersburg. I have not seen any other details given of her than that she is 20 feet long, and is propelled by a screw worked by four men; that she descends and ascends by increasing and diminishing her water ballast; she is said to be held in horizontal position by shifting the water ballast longitudinally fore and aft; air is supplied through chemical means to keep her crew under water up to nine hours. She is said to have

often descended to a depth of 15 feet, and her speed is 3 knots. A considerable number of these "Bjevalskys" are reported to have been built for coast defence in Russia.

The "Engineering," of 20th November, contains a very full description of the "Goubet" system of submarine boat, a large number of which are said to have been ordered by the Russian Government. This description seems very like what in Russia is called the "Bjevalsky" system, though the "Goubet" boat requires only two men. The "Goubet" boat descends and ascends by taking in and pumping out water, in addition to which a heavy weight can be dropped if it is necessary to rise to the surface more quickly than by pumping out water. The mine contains 110 lbs. of dynamite, and when the submarine boat has reached a position directly underneath the enemy's vessel the mine is cast off and rises through its floatability, when it is meant to attach itself to the bottom of the vessel by means of a ring of spikes; this done, the submarine boat retires to a safe distance and the mine is fired electrically through a connecting wire.

It is intended to apply electrical motive power to this boat by accumulators; but the constructors do not seem to place much faith in this, as they have applied oars to be used if or when the electrical motors fail.

Mr. Garrett designed a submarine boat some ten years ago, and one was built by Messrs. Cochrane, of Liverpool. This boat was 45 feet long, of the shape of two cones, with a central cylindrical portion. It descended by means of pistons which varied the displacement of the boat by being drawn in and pushed out, as well as by central rudders which steered it up and down like the Confederate boat. Compressed air as well as chemical compounds were carried to give air to the crew. This boat was never applied to war purposes, but after a number of experiments it was lost off the Welsh coast, and I have had much advantage of the negative experience gained during those experiments in avoiding the faults which made that boat unsuccessful.

The idea seems throughout to have been admitted that submarine boats, if successful, would become most valuable and comparatively inexpensive weapons for port defence; but none of the boats so far have given satisfaction, and I now beg to give my views as to the reason of their failure.

1. They were always built too small and too weak. The longest of previous submarine boats was 45 feet, or about half as long as my boats. Their small dimensions and weak plates made them useless in bad weather and dangerous for submersion, especially if touching the bottom, or if coming in contact with any vessel. The small air space available in such small boats also forced the crew to use chemical means to obtain pure air.

2. They have never been made for firing a fish torpedo, consequently they have had to endeavour to fix a mine to the bottom of a vessel, which I consider impracticable, considering the risk of contact with the vessel, which, especially if pitching or moving, might easily destroy the boat. This also necessitates a complication of clockwork

or electrical connections to enable the boat to get away to avoid the fatal risk of being destroyed by the attacked vessel, as was the case with the boat which sank the "Housatonic."

3. In all the early boats the mines were charged with only black powder, the effect of which was less destructive than that of the gun-cotton or dynamite in the fish torpedoes; and the effect of the explosion against a wooden ship was nothing like as serious as against the thin bottom plates of an ironclad.

4. All the boats hitherto in use have been propelled by hand power. This gave too much hard work to the crew, who could not take the boat any distance on the surface previous to the actual attack, and made it quite impossible to face any rough weather.

In my boats, the use of steam diminishes the number of men, and they have so little to do when below the surface, that the temperature, which is anyhow lower than in modern stokeholes, is no detriment; the stokers, for instance, in my boats, have nothing at all to do when the boats are submerged. My boats can go 150 miles and upwards, previous to the attack, without re-coaling.

5. All previous boats had most unreliable means of descending and ascending. The descent by steering downwards in the American boats, twenty years ago, was quite as dangerous as the attempts before and after that time to lower and raise the boats, and to keep them steady at any desired depth, by means of increasing and decreasing the weight of the boats by more or less water-ballast, or by altering their displacement.

None of these boats used the principle which I have applied to pull the boat down by mechanical means, while relying upon its always retained buoyancy for rising; so that if the mechanical apparatus fail, the boat rises at once to the surface. Nor did they have the tendency to steadiness given by the two forces of constant pulling down, by my horizontal screws, acting all the time, whether still or moving, against the pulling upwards caused by the buoyancy.

I should consider it most dangerous to rely upon a detachable weight in case of emergency, as the apparatus for detaching it would be always liable to fail.

I cannot imagine how the longitudinal instability of a submerged boat can possibly have been satisfactorily controlled by any of the means applied to the previous boats; and even if the appliances used had been more perfect, they would probably not have been sufficiently effective for such very light boats without much inertia. Even Goubet's system of moving water or weights fore and aft inside the boat must act much more slowly, and cause more diving and oscillation than my rudders, which always remain in the horizontal, and thus control the slightest tendency of the boat to get out of the longitudinally horizontal position.

I consider it absolutely essential to keep the boat horizontal when moving, as any inclination downwards, with the impetus of a heavy boat, would almost to a certainty carry the boat below its safe depth before it could be effectually counteracted by shifting weights.

These are, as far as I have been able to ascertain, the more

important steps in the direction of submarine boats, which had been taken previous to my attention being drawn to the subject, five years ago.

The position, then, as regards torpedo warfare, seemed to me to be as follows :

The submarine mines, placed at the bottom or floating anchored, had been adopted generally ; but they were acknowledged not to fully satisfy the requirements for port defence, because they were immovable, and were exposed to be picked up by the enemy.

The towed torpedoes of the Harvey class had not given satisfaction, and the spar torpedoes could only be used under very exceptional circumstances. The Whitehead and Schwarzkopf fish torpedoes were then the only ones which gave any hope of usefulness by future development.

Apart from the faults and difficulties in the construction and management of the fish torpedo itself, there seemed to be an almost insuperable difficulty in carrying it, with any degree of certainty, up to the short distance at which it could be considered infallibly effective.

The fish torpedo is practically a projectile, and the torpedo boat may be called the gun which fires it ; but the great expense in time of peace, added to the certainty of losing a number of these boats in war, made this means of discharging torpedoes exceedingly costly and unreliable.

It seemed to me, therefore, of great importance to construct a means of carrying, with greater safety, the fish torpedoes up to such a short distance from the vessel to be attacked, as that the torpedo could not fail to hit.

The surface torpedo-boats at that date were met by machine-guns which made their attack in daytime almost impossible ; and the improvements in the direction of greater speed and thicker protection of their vital parts, have been met by greater power and longer range of the quick-firing machine-guns, while their larger dimensions offer a target more easily hit. Thus, to-day, the surface torpedo-boats really do not offer much greater certainty of reaching striking distance than they did five years ago.

It seemed to me that a much greater chance would be given for carrying the Whitehead torpedo within striking distance, if, instead of trying to rush the distance by many boats all the time exposed to the destructive fire from machine-guns, I could carry the torpedo secretly up to this distance without the probability of being seen at all, and without any probability of being struck by the enemy's shot, even if seen.

This led me to take up—with a view to make it a practical success—the question of submarine boats ; and, instead of publishing any accounts of my proposals, I thought it best to build at once such a submarine boat as could not be suspected of being only an experimental boat, but one really useful in war.

I propose to describe the boat itself, and then to give my views about its utility and manœuvring.

The first boat I built at Stockholm, and which I had the honour to run at the experiments in Sweden last September, in the presence of delegates from most of the leading Governments, is shown on the drawing No. 1. The following are its principal dimensions and details:

Length 64 feet, beam 9 feet, but over sponsons 12 feet, draft 11 feet; displacement 60 tons; speed, on measured mile, 9 knots; distance travelled without re-coaling, 150 miles; depth to which it can safely descend, about 50 feet.

Engines, surface condensing compound type, with 2 cylinders and cranks at 90° , and, at pressure of 100 lbs. to square inch, will indicate 100 horse-power. Boiler of ordinary marine return tube type, having 1 furnace, and about 200 square feet of heating surface.

Two hot water cisterns, rhomboidal in body, with spherical ends.

The boilers and cisterns contain about 8 tons of water. Both boilers and cisterns are made for a working pressure of 150 lbs. to square inch.

One fish torpedo, 14 feet, is carried outside on the bow, and discharged mechanically.

The sinking apparatus consists of 2 horizontal propellers driven by a 6 horse-power double cylinder engine. These propellers are placed in sponsons on each side of the boat.

One cold water tank in centre of boat, holding about 4 tons of water for regulating buoyancy. This tank is used as coal bunker when doing long surface runs. Crew, three men.

For longer distances, out of sight of the enemy, the boat runs on the surface, with the cupola and about 3 feet of its turtle back out of water, but by forced draught, blowing out its smoke under the surface.

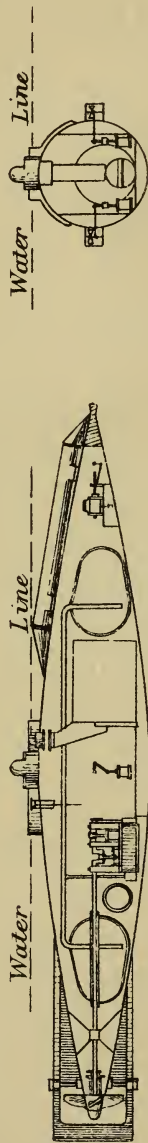
When the boat arrives within such distance of the enemy that it might be discovered, it descends into the water so far that the cupola alone appears above water; this is done by taking in water into the cold water tanks sufficient to reduce the floatability to what my horizontal screws are capable of overpowering; she runs thus "awash" until she arrives so near that even the small cupola might be discovered, then she descends altogether below the surface and advances up to striking distance entirely submerged, unless she requires to show the cupola above the surface once or twice for a few seconds to adjust her direction.

The above-named reduced floatability is never done away with, but the descent from the "awash" position is effected by starting the horizontal screws, thus overcoming mechanically the buoyancy of the boat, which is pulled down to a less or greater depth, depending upon the speed given to the horizontal screws.

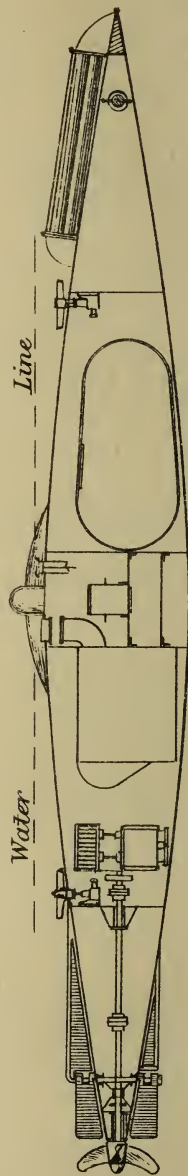
As the density of water does not alter at varying depths, I can always count upon the exact amount of buoyancy being available for raising the boat to the surface whenever I stop the horizontal screws, or for lifting the boat nearer to the surface when I reduce the speed of the engines driving them. Thus, if any failure of these engines or propellers were to take place the boat would at once rise to the surface.

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NORDENFELT SUBMARINE BOAT.



Nº 1. 64 FT. BOAT



Nº 2. 100 FT. BOAT.

In addition to my controlling the depth by varying the speed of the horizontal propellers, I have applied an apparatus for definitely regulating the depth at which I mean to move; this consists of a valve which controls the steam supply to the small engine; this valve being held open by a weight adjustable on a lever, the piston of the valve is also in direct communication with the sea, in such a manner that when I reach a depth at which the pressure in the sea is more than the pressure of the weight, the valve closes, the engines stop, and the buoyancy raises the boat until the outside pressure diminishes, when the weight again opens the valve. By this means I exactly regulate the depth at which I desire to move.

When descending below the surface I carry altogether about eight tons of water, subject to the full pressure of steam, so that in case of more leakage than I can pump out of the boat by my steam pumps, I can at once counteract such leakage and rise to the surface by blowing out water. This must be much more reliable than to detach weights.

On the surface I drive the boat by working the boiler in the usual manner, and I keep up the temperature of the water in the cisterns to a degree corresponding to a steam pressure of 150 lbs. When I wish to descend, I close the ashpit and fire-door, then I close up the funnel inside boat and start the horizontal propellers.

At this moment I thus have, as propelling power under water, the steam which will be given off by the heated water (about eight tons), and this has been found sufficient for a distance run of 14 knots; or more than is required for an attack in war. On that occasion we had still over 20 lbs. pressure in the boiler when the boat was opened up.

The boat is laterally very stiff, as I carry some six tons of lead in the bilge.

Longitudinally the boat is balanced before starting by the arrangements of weights, and this can be adjusted by having more or less water in the two cisterns fore and aft.

When descending, the boat is perfectly horizontal, and is invariably kept so when moving under water, by means of the bow rudders operated by a plumb weight. These bow rudders have been found to act so perfectly, that there is actually no appreciable change from the horizontal position.

Although the centre of gravity is well under the metacentre, the boat is so sensitive longitudinally, that the bow rudders correct instantly any tendency to deviation from the horizontal position.

Since the Swedish trials in September last, I have had time to adapt to that boat all the more important improvements which have been suggested by the experience gained, so that this boat is now a thoroughly efficient instrument for practical use.

Three men are sufficient crew for the boat, and I have proved that these men do not require any other air for sustenance in comfort than what the air space in the boat itself contains.

The dimensions of this first boat, as well as its speed and proportions, were settled especially for defence of coasts where there is an archipelago, as in Sweden, the west of Scotland, &c., and for the defence of ports with long estuaries, for instance, London, Liver-

pool, &c., and I am still convinced that where handiness and small draught of water are important factors, these proportions cannot be much improved upon.

For the defence of open coasts and for operations where it may be necessary to keep the sea for days together, without being able to seek the shelter of inlets or the mouths of rivers, other and larger proportions will, of course, be desirable, and I am now constructing boats on such larger lines, feeling certain that both the smaller and larger types will become necessary.

The lines of my boats are drawn specially suitable for giving least resistance when the boats are submerged, consequently they are not so good when part of the boat is above water. The surface speed of my small boat being 9 knots, she is capable of even greater speed when submerged, thus she can always, whether on the surface or below, do 4 to 5 knots against a 4-mile current.

The question of what speed below water is most desirable, must be found out by experience, and must depend upon the room and depth of water available, and upon how far greater speed, when submerged, may tend to detract from the secrecy of attack, and upon other questions which can only be determined by lengthened practice by intelligent Officers, when fully trained to its use.

The following are the details of my larger boats (Drawing No. 2):—

Length 100 feet, beam 12 feet, displacement 160 tons, speed on measured mile 12 knots, distance travelled without re-coaling 900 miles, depth to which it can safely descend about 50 feet.

Engines are of surface condensing compound type, with two cylinders, and cranks at 90° , and at a pressure of 100 lbs. of steam will indicate 250 horse-power.

Boiler is of the ordinary marine return tube type, having two furnaces; about 750 square feet of heating surface.

Hot water cistern is rhomboidal in body with spherical ends.

Both boiler and cistern are made for a working pressure of 150 lbs. per square inch.

Two fish torpedoes, 14 feet long, are carried outside on the bow, which are discharged mechanically.

Sinking apparatus consists of two vertical propellers driven by two engines, which each indicate 6 horse-power.

Two main cold water cisterns placed at each end, and containing 15 tons of water each, also one in centre of boat for regulating buoyancy, containing 7 tons, coal bunkers on the side of boiler; 8 tons of coal are carried at the side of hot water cistern and in middle of boat.

Crew.—Three men in a watch; two watches carried.

With coal in the bunkers only, this boat can keep the sea for five days or more, and thus would be especially suitable for cruising off the south coast of England, ready to defend any port in the channel which might be threatened, or for action as despatch boat in passing unseen an enemy's line of vessels.

Both the large and small boats are, of course, provided with compasses, pressure gauges, and all instruments required for gauging the

depth under the surface, the balancing of the boat, the purity of the air, and for all other purposes connected with submarine warfare.

The three main points in my system of submarine boat to which I particularly wish to draw attention, are :—

1st. That by using water as the means of storing up energy, I am in possession of a reservoir which can never get out of order and which can be replaced at any hour in any part of the world, and without any extraneous assistance from shore or other ships. Whereas if electricity were used, delicate and special apparatus would have to be employed as reservoirs of energy, such as accumulators or batteries, which if they should require repair or replacement would render the boat completely *hors de combat*, unless she were within reach of some electrical depôt. Also the durability of the cistern containing the water is immensely greater than of electrical apparatuses, which—should a run of any distance be required—would still have to be provided with engines for the replenishing of their power.

These objections also lie against the use of caustic soda or compressed air.

Besides, after carefully investigating what could be done in other ways, I was fully convinced that I could by no other method store so much energy as by using heated water, especially as I have made it a point to design engines for my boats in such a manner that as long as I can have high pressure in my boiler I can use expansion; yet as the pressure falls in the boiler by reason of the steam being used when under water, I can regulate my engines so that they will work well down to and even below the atmospheric pressure.

The reason of all others which at once decided me to adopt the hot-water system, was the enormous factor of safety obtained by my being able to blow out by steam pressure, without the use of machinery, large weights of water, which would lighten the boat and counteract any leak likely to occur.

Finally, I preferred to use the hot-water system because, the motive power being steam, ordinary marine engineers are at once familiar with it, and would have more confidence in the boat than if any new, delicate, or comparatively untried system were adopted.

2nd. The submerging the boat by mechanical means. I feel confident that previous attempts have proved unsuccessful mainly because either they depended upon varying the displacement of the boat by taking in water to submerge her, and to regulate the depth at which they desired to operate, or they descended by steering downwards.

My objection to the first-named method of descending by taking in water, and thus increasing the specific gravity of the boat, is, that practically there is no difference of the specific gravity of water on the surface and at 50 feet depth; thus, when the boat has lost its buoyancy at the surface, it has also no buoyancy at any given depth, and the risk is thus very great of suddenly descending beyond a safe depth.

Further, by this method they relied upon some mechanical means for ascending by ejecting water. In case such mechanical means failed, the boat would be lost.

As regards the method of descending by steering downwards, I need only point out the great risk of allowing an object 100 feet long and of great weight to proceed in the downward direction even at a small angle, as the impetus gained would very easily carry it beyond safe depth so quickly that they might not have time to check it.

On the other hand, by my system I rely upon no mechanical means for rising. I keep myself, by means of the speed of the horizontal propellers and the regulators, at any desired depth, with a sufficient force to keep steady when advancing at that depth; and as I never cause the boat to leave the horizontal position, I am safe against the effect of impetus in a downward direction.

3rd. The horizontal position I have found to be a *sine quâ non* for a submarine boat, and I have already above shown the great risk in allowing the boat to descend at an inclination. I have, therefore, provided rudders which I prefer to place in the bow of the boat, and which by the action of a plumb weight are always held in the horizontal position, and, therefore, should the boat from any cause tend to take a direction other than the horizontal, these rudders will immediately bring the boat back to the horizontal position.

During experiments continued for a couple of years I have found these rudders perfectly reliable, and they have never failed to effect their purpose.

In addition to these three main features of my submarine boats there are a few more points to which I wish to direct attention.

There is really no trouble at all about the heat or the sufficiency of sound fresh air in the boats.

The heat after the 14 miles run above named was only 32° C. (90° F.), and after the first run at Landskrona, when the crew had been closed in from the outer air for three hours, the temperature was taken by two of the delegated Officers at 31° C. (88° F.), while I am informed that in some monitors the stokehole temperature rises to 49° C. (120° F.), and I suppose that it is not much cooler in some of the larger modern ironclads.

As to the purity of air, there have been four men enclosed in the boat for six hours without any appreciable diminution in the length of flame of a tallow candle placed on the floor, the level where the air should be most impure.

There is, of course, no reason why I should not carry compressed air, caustic potash, chlorine, or other well-known chemical compounds for purifying the air, in lieu of the lead ballast, except that I do not consider the complication to be necessary; as, in the case of war, many opportunities would occur for opening up the cupola for a minute, or for turning on the forced draught, and filling the boat again with pure air.

I have not had the slightest difficulty in finding crews. My first engineer was one from the merchant service, my second one was engineer in the Swedish Navy, and my third one was again a civilian; any number of stokers have always offered their services, and many Swedish Naval Officers have urged me to let them command the boat. The risk to the crews ought to be very slight, and in war I consider

that they would be safer in my boats than in many other positions. In case of accident the boat can always come to the surface and the men can escape with life-belts.

The Captain would soon be accustomed to study and become familiar with the appearance of the coast and other objects from the low level of the cupola when awash. Still, this, like all other parts of the boat, has to be studied, and men have to be trained in order to make the boat really efficient. No untrained man can hit a bullseye, or ride a bicycle, or play the piano; still they are easy things enough when learnt.

I have delayed the completion of my first boat for years in order to take away all complications. I have nothing but ordinary steam and ordinary engines; still, the engineer and the stoker should be so familiar with the position of all cocks, valves, and pumps as to find instantly and almost mechanically the right handle at any important moment.

The Officers who are to command these boats ought to study, perhaps for years, their manœuvring power, and the best manner in which they are to be made most useful in war. If not, they may fail at any moment when they are relied upon by the naval authorities. I put very great strain upon this training in good time, as I am bound to admit that any number of these boats, if constructed suddenly before the commencement of a great war, would probably not be as useful as half their number in the hands of Officers and crews who had previously become familiar with them for years in time of peace.

In training crews they would, of course, at first work for a time with the boat "awash," showing only the cupola, as, even in time of war, the boat will often be most useful also in this position.

My compasses work in the same manner as in all other iron ships; that is, they do not work as satisfactorily as when raised far above the iron—but, as they work exactly the same whether the boat is on the surface or submerged, I can always take the bearing before descending and then be safely guided by the compass below.

General Hardinge Steward has suggested to apply a telescopic mirror, and this may be very useful on occasions when the boat may not like to show its entire cupola, nor to descend altogether, but wishes to advance while keeping the enemy's ship in view with only the small tube which holds the mirror above water.

Lieutenant Hovgaard suggests that some electrical power should be carried in accumulators in addition to the steam power; this can of course be done if found useful, but I would prefer to avoid complication by carrying the weight of such accumulators and electrical motor in additional heated water.

The main safety of the boat, of course, lies in the utter improbability of the enemy knowing that the boat is near, or that any attack is intended; next, it lies in the very short period of a few seconds in which the cupola appears above water, and which would generally not be long enough to enable the enemy's guns to ascertain the range. If the cupola be hit the boat is not disabled, as there is a cover which can at once be slung across the opening and make it watertight, so that

the boat can again descend out of sight and go away to put on a spare cupola.

The actual turtle back of the boat can easily be protected against the shots of machine-guns or quick-firing guns by its being covered by a 1-inch steel plate in addition to the skin, but any shells, if they hit the turtle back, would strike at such an exceedingly acute angle that this additional weight would really not be required.

When the boat runs "awash" the water which covers the remainder of the entire boat, except the cupola, would be the safest armour that could possibly be devised.

My boats are armed with one or two Whitehead torpedoes in tubes, and as soon as my controlled electrical torpedo is ready, I propose to tow one of these as well.

This torpedo will offer the advantage that steel wire nets would be no protection against it, as the nets would be torn asunder or brought close to the ship's side by the impetus of the torpedo weighing 4 tons, striking with a speed of fifteen miles an hour, so that its charge of 300 lbs. of dynamite must explode as near to the ship as is required to make that heavy charge thoroughly effective.

To defend the submarine boat against surface torpedo boats, I mean to carry either a 2-lb. quick-firing shell-gun or a couple of MacEvoy's small spring torpedoes, besides which my boats are so strong and so handy, that they would ram and sink any surface torpedo boat with which they may come into contact.

As a large ironclad costs as much as from 50 to 100 of my submarine boats, the question of expense cannot be of much consideration, and I am convinced that as soon as different nations become familiar with the boats, and when naval Officers, by their practical use, have determined the best way of making their manœuvring most effective, they must be adopted in large numbers. As soon as it is acknowledged that the boats are safe, and can be easily managed, in consequence of my having made them simple and easily handled, by eliminating all complicated or dangerous motive powers or mechanisms, and by only calling upon the boats to do what they can easily do, without any reminiscences of the fantastic though fascinating writings of Jules Verne, it does not require much imagination on my part to see, a few years hence, great numbers of these boats defending such waters as the Thames, the Mersey, the Clyde, the Humber, the Straits of Gibraltar, the Bosphorus and Dardanelles, the Suez Canal, Rio Janeiro, the La Plata, and such ports as Portsmouth, Plymouth, Cork, Edinburgh, Hamburg, Wilhelmshafen, Copenhagen, Kiel, Carlskrona, Cronstadt, Brest, Cherbourg, Ferrol, Lisbon, Cadiz, Carthagena, Marseilles, Toulon, Genoa, Spezia, Naples, Trieste, Odessa, Alexandria, New York, New Orleans, and all the important stations and shipping ports in India, China, Japan, Australia, South Africa, and the American continents.

In almost every case, when I examine the charts of such ports, I find some especially suitable points in favour of the use of submarine boats.

I have heard the opinion expressed that the general adoption of

submarine boats may act detrimentally to the interests of this country, because the boats might enable smaller countries to defend their ports to a certain degree against more powerful navies.

It is true that the submarine boats are important in the first instance to countries which cannot afford to follow the constantly changing systems of costly ironclads—but, rich though England be, it must be important also to this great Empire, if a cheap means of defence can be worked out for her coasts, her Colonies, and her coaling stations, which would leave her ironclads free to fight on the high seas, and her swift cruisers free to follow and protect her own merchant navy, or to destroy the merchant navies and commerce of her enemies.

I have never heard it stated that the British Navy has too many modern war-ships even for these purposes, let alone coast defence, and I cannot imagine any less costly means of defence of Colonial ports and coaling stations than such submarine boats as, in the absence of fortifications, may be able to defend their commerce until there is time for the Imperial Navy to come to their assistance.

Admiral ARTHUR, C.B.: Mr. Chairman, your Royal Highness, and gentlemen, this is a subject in which I have taken very great interest. I do not intend to address you at any length, but there are a few points on which I think we may dwell with great satisfaction. I consider that not the least important feature of the interesting paper read by Mr. Nordenfelt to-day is the clear way in which he has pointed out to us the absolute necessity, in all vessels which navigate under water, of keeping the horizontal position. This has been the point which has led us astray with the Whitehead. If we had maintained from the first the horizontal position by means of two horizontal rudders, one at each extremity, instead of one rudder placed in the stern only, we should now be in a much better position than we are. The Whitehead torpedo is a submarine boat, and has been going now upwards of fifteen years. We have constantly strengthened it to correct the danger increased by its going at too great a depth, and we have only lately come to the conclusion which Mr. Nordenfelt has so clearly put before us—the absolute necessity of maintaining a horizontal position to prevent an abnormal dive. I have reported on a great number of submarine boats of many descriptions, but the report has always concluded by saying that I could conceive of no opportunity for using these boats with any effect whilst under water. I was one day discussing this subject with a Russian naval Officer who had commanded a submarine vessel for three years, and I asked him that question: “Can you conceive of any situation in naval warfare in which a submarine vessel could be of any use?” His answer was to the point, and conclusive; he said, “No, certainly not; whilst a submarine vessel is submerged she is totally useless. But let the submarine vessel be so constructed that she can stick with her turtle-back just appearing above water, and then I will approach the whole British fleet, and allow them to fire on me, and I undertake to get into position near enough to discharge the Whitehead torpedo.” I think that is the point we must come to. We want torpedo-boats that can steam at a high speed with almost total immersion. Undoubtedly to do this they must have the power of going entirely under water, but such would be exceptional and for very short periods. My opinion is that all torpedo-boats should be submarine boats—that is to say, they must have the power of going under water if required, but they must be able to steam at a high rate of speed along the surface. I should think we may eventually arrive at being able to solve the question of maintaining the same speed they have at present, viz., of 20 knots an hour; we should get that at a light draught, for which purpose some alteration in the position of the screws would be necessary, then with the turtle-back awash we should get 13 knots—and we may be quite satisfied with 6 knots or less on total immersion. I think those

are the two principal points that we have to dwell on to-day. You will all agree with me that the system of drawing a vessel down instead of guiding her down is the one we must rely upon. That is one of the most novel points in Mr. Nordenfelt's design, and I think it is the most important one.

Admiral the Right Hon. Sir ASTLEY COOPER KEY, G.C.B., F.R.S.: In any remarks that we may make on this very interesting paper that we have heard read by Mr. Nordenfelt on a somewhat startling subject, I at all events will speak with very great diffidence on the points raised, as I have never seen anything in the shape of a submarine locomotive at work. Mr. Nordenfelt has had actual experience in the management of one of them for some years, and he speaks, therefore, not only from the sources of his great knowledge and engineering skill, but with the great power of practical experience. I may mention that Mr. Nordenfelt has in his historical summary omitted to include an invention of a submarine boat which was considered to have been of considerable importance during the Crimean war; it was proposed by Mr. Scott Russell, one of the most eminent engineers of the day. It was thought highly of by the Government, and Lord Palmerston, then Prime Minister, sanctioned an expenditure of 7,000*l.* on its construction and trial. Sir James Hope, Sir James Sullivan, and I were appointed to report on its capabilities. I need scarcely say that it was a failure, but it serves to illustrate the great advance that Mr. Nordenfelt has made in the submarine boat he now proposes. I did not like the look of Mr. Scott Russell's vessel. It was merely a large diving-bell, like an inverted boat. Ten men were supposed to go in it. It was to be lowered by admitting water into a compartment, and to be raised by pumping it out or by blowing it out with compressed air. It went down to the bottom with the men under it; they were to walk on the bottom and propel the boat by pressing against thwarts fixed to the under side of the boat. The boat looked rather doubtful as to its rising to the surface, having a long strop and thimble attached, and a buoy with long buoy-rope. The boat went down and remained there twenty minutes; a tackle was sent down hooked to the strop, and up came the boat just in time. They were bold enough to try it a second time, but with no greater success. The second time it came up suddenly, blew like a whale, and capsized. I mention this to show that many years ago the submarine boat was considered an important weapon of offence; in that case it had a special object. As I have said, in any remarks I may make on this proposal I do it with great diffidence, but I do not think Mr. Nordenfelt has paid sufficient attention to the necessity for speed. He says that when floating on the water she will go 9 knots, and therefore when she is totally immersed she will go faster. I should like to see this proved—until then I question it—and I think it is of importance. The armament of this boat is one Whitehead torpedo. If she is to attack by creeping up to a vessel (which I think is by far the surest plan) it must be to a vessel at rest. If a vessel is at rest she will probably have her nets out, against which a Whitehead torpedo of the old type has very little effect, and thus you have a most formidable vessel only armed with one Whitehead, against which a ship at anchor is quite protected. If, however, the ship is under way and has greater speed she can of course escape from her assailant.

Mr. NORDENFELT: The larger boat runs 12 or 13.

Sir COOPER KEY: I should be very pleased to see the larger boat. There are one or two questions I should like to ask. I think it is a matter of very great importance, as Mr. Nordenfelt has pointed out, that the smoke is discharged under water; but I should like to know, when it is so discharged, does it make its appearance at the surface?

Mr. NORDENFELT: It bubbles a little, but no smoke comes out.

Sir COOPER KEY: I should be rather afraid that it might appear on the surface, and thus indicate the approach of the vessel.

Mr. NORDENFELT: Not when it is under the water.

Sir COOPER KEY: You say she can be sunk to a safety depth: does that safety depth mean that beyond it the body of the boat will be crushed or altered in shape?

Mr. NORDENFELT: It means that the buoyancy would be taken away.

Sir COOPER KEY: Those are two points I wished to know. As regards the compass, which it is suggested might be a difficulty, I do not believe you will find

it so, because Sir William Thomson's compass when used on an ironclad surrounded by iron in a conning-tower works satisfactorily.

MR. NORDENFELT: I was told the same thing yesterday: I was not previously aware of it.

SIR COOPER KEY: I do not think there will be a difficulty on that point. The most important point connected with submarine boats is that which has been pointed out by Admiral Arthur. In our investigations on the boat I have referred to during the Crimean war, we came to the conclusion that it would be perfectly useless, because you cannot see under water sufficiently to guide you to any given object. In Mr. Nordenfelt's boat there is no means of seeing under water; therefore I believe that unless you can approach a vessel with your cupola above water, to see where your enemy is, and the direction and distance you should steer, you will not effect much. You might approach it this way during twilight, or by night, or in a fog without much difficulty. I doubt whether anyone would go down under water and fire the only implement of destruction he possesses at a vessel that he does not see; but I do think that with the cupola above water, or with the smaller cupola and projecting mirror, it would prove a very formidable means of attack. I think the principles which Mr. Nordenfelt has adopted—in the first place having his stored energy in such a simple medium as hot water, and in the second place having the means of raising and lowering the boat by the mechanical means of vertical screws and bow rudders—are both sound and admirable. We have heard much nonsense talked about regulating the depth by the specific gravity of the boat when under water. If, however, she is made heavier than the water, down she goes to the bottom. If she is lighter than the water, she comes to the top. Without mechanical appliances there is no reliable means of keeping her at a fixed distance below the surface or having it in your power to raise and lower the boat with regularity. I believe that this submarine boat has a great future, and that Mr. Nordenfelt has achieved a great success. As I have said, the question of speed is one to which a little more attention might be paid; and it must also be borne in mind that when you are going to fire a torpedo you must see the vessel you are going to fire at.

Vice-Admiral H.R.H. DUKE OF EDINBURGH, K.G.: Sir Andrew Clarke and gentlemen, I am very glad to have been able to be present to hear this lecture of my friend Mr. Nordenfelt, who has already done so much for science and for the improvement of many matters connected with warfare. I may say that I fully agree with Sir Cooper Key, who has just said that Mr. Nordenfelt has done very much towards solving a problem which is likely to be of great importance in future naval operations. He has had the great advantage of practical experience with these boats, and they have so far proved a great success over all preceding attempts to manufacture a submarine boat. There is one point which I think Mr. Nordenfelt's experience has not tested, or in which he has not already gained experience—and it is one which might be raised in a discussion like the present. We have not heard in the lecture—nor has it been in any other way mentioned—in what manner the torpedo is to be delivered against the ship. It has already been said that when you are attacking a ship absolutely at rest, which means a ship at anchor, having risen to the surface and taken your exact bearings, you may with a tolerable degree of certainty be able to strike the vessel, provided the power of the torpedo is sufficient to force in the nets and burst near enough to the ship. But not having heard it stated in what manner the torpedo is to be discharged, it strikes me that the submarine boat may get so near to a ship that when the explosion of so large a charge as 300 lbs. of dynamite takes place, the people in the boat or the boat itself may be destroyed by it. I say this, because in the Service we never should dream of exploding a large charge of dynamite if we had divers down within a very great distance, and those who have seen submarine mines exploded will know at what an enormous distance fish are destroyed by them. That is owing to the simple fact—which has been more or less described by Mr. Nordenfelt himself—that water is of the same density at all distances; in other words, it is an incompressible substance, and a blow struck at a certain place is transmitted a very great distance before its effects are in any way diminished. I feel, therefore, that it is extremely desirable that experiments should be made before risking the lives of men in a boat of this descrip-

tion for the purpose of seeing whether they would suffer in the way I have alluded to. When turret-ships were first constructed, an experiment was carried out, if I mistake not, at Spithead, on board the "Royal Sovereign," where they put goats, cocks and hens inside one of the turrets, and fired the gun to see the effect that the explosion would be likely to have upon the gun's crew. An experiment of a similar nature might be tried with the submarine boat. I do not mean that goats or cocks and hens should be put under water for any length of time, but remembering the example I have given of fish being destroyed at such an immense distance, you might have vessels containing fish placed at certain distances, and in that way ascertain the destructive limits of the explosion. I merely throw this out as a suggestion, but I think the point is worthy of consideration. I will only add how very much I have enjoyed listening to this lecture, and how heartily I wish success to the invention which Mr. Nordenfelt has brought before us.

Admiral FREMANTLE: I rise simply to ask a question on a point which I think Mr. Nordenfelt did not explain to us, and which has not been touched upon by other speakers. I wish to know the method of discharge which is to adopted for this torpedo below water, and also whether it would have any effect on the horizontality of the boat when it is discharged, because, as Mr. Nordenfelt has told us, it is a very great advantage to keep the boat in a horizontal position.

Admiral SELWYN: Mr. Chairman, your Royal Highness, and gentlemen, I admire, in common with most of the gentlemen present, the extreme ingenuity that Mr. Nordenfelt has displayed in this comparatively new subject, because he has been the first to consider the whole of the forces in operation, which a great many of us have left unattended to. I am afraid, I must confess, that in some parts of it, I myself, in designing some years ago a submarine boat for the Turkish Government, also relied upon man power, but I did so because I never intended that it should be used for anything but cutting off submarine mines. In that boat we proposed to use sulphate of soda for the absorption of the carbonic acid, which I believe is by far the best—Glauber's salts—and I have no doubt that would meet all the requirements in a very small boat. Mr. Nordenfelt has now taken us into the consideration of how big we may make these vessels. He has begun with a very practical and useful illustration, but he has forced us to consider that there is scarcely any limit to the size to which we may usefully take this vessel. It at once supersedes in a very large degree the necessity for armour or for considerations of that kind, and eventually we may have to acknowledge that Jules Verne was not very far wrong when he led us in a submarine vessel all round the ocean. The question of propulsion at a high speed is one which has recently approached solution more nearly than we have ever known it before. At the Inventions Exhibition a steam-engine was shown for the first time which combined enormous speed with great economy. Our rotary engines in the past have given us great speed, or up to what we called great speed—that is, up to about 1,000 or 2,000 revolutions a minute. This engine, the invention of Mr. Parsons, the son of the late Lord Rosse, for the first time gives us high economy—21 expansions, which is very high economy indeed in an engine which is capable of 16,000 revolutions a minute. Now this is a question of propulsion which is very easily understood when we consider that one immense difficulty has been to obtain reciprocating engines which would drive at high speeds, and drive a small screw of this kind at high speeds such as we desire, without too much liability to breaking down. This, which belongs to a certain extent to the class of rotary engines—but is more a turbine engine than a rotary engine—is free from all those objections. It is visible now at Lincoln's-Inn, where it lights the whole of the establishment and gives double the number of electric lights for the same boiler power that any other engine does. This is an enormous improvement, and I could not suggest to anyone a better means of measuring the actual effect produced than that of the increase in the number of electric lamps. While our indicator diagrams are liable to a great many errors, the number of electric lights you can burn from a given power is liable to no such error—it is an absolute measure of efficiency. With such an engine there seems to me no great difficulty in driving a vessel of this kind at any speed that any torpedo-boat has ever yet attained. I should be disposed to say that a very little further consideration would lead to the banishment of the screw altogether, and to a speed very much

exceeding that which has already been obtained by torpedo-boats. That torpedo-boats would also rise in speed considerably is of course to be expected, but that would at once meet the objection to the low speed already attained. With simple means such as Mr. Nordenfelt has used, I do not see that we can find fault with the speed of 9 and 13 knots. I think we ought to congratulate him that he has done so well. I also see no reason, derived from the increased frictional surfaces, why the speed obtained under water should not be greater than that obtained above it, for the bow wave, which has long been known as an enemy of high speeds, which prevents a torpedo-boat obtaining any great speed till she begins to ride upon it, is clearly absent when you drive a vessel of this shape entirely under water. The fish is endowed with a perfectly devised shape for the work it has to do under water, and when we imitate a fish above water I think we very often commit a grave error. When Mr. Nordenfelt devises a submarine boat, he naturally adopts the submarine form, and I think very wisely does so. With regard to the procedure above water within the distances at which I presume Mr. Nordenfelt would use the torpedo, I really do not see that there is any great difficulty in setting a course—considering the current and other circumstances—very nearly as well as he could above water. I believe the faculty of rising is most important, and that it has been accomplished in the most perfect manner by Mr. Nordenfelt's device of the vertical screw; but that there is any grave difficulty other than that which must necessarily accompany fogs and darkness in successful attack by a torpedo, I really do not see. I think Mr. Nordenfelt is to be congratulated on having made an enormous step forward, and one which I am sure has a great future before it.

Admiral BOYS: There are two questions that I should like to ask, but I will premise by expressing my thanks to Mr. Nordenfelt for introducing this subject, and complimenting him on his invention. It is not like very many inventions that are brought before us, and which simply exist upon paper; but here is an implement that really exists that Mr. Nordenfelt has to a certain extent perfected. He has built it and worked it. I am sure he is anxious for criticism, because by asking questions about designs, and pointing out what we may imagine to be their failings, inventors and gentlemen like Mr. Nordenfelt are able to make improvements and perfect them. One question I would ask is, what depth of water Mr. Nordenfelt thinks is necessary for the navigation of his larger vessel, because it appears to me that the immunity of a vessel from the attack of these boats will depend to a great extent upon the shallowness of the water she may be anchored in. I should also like to know how the torpedo is placed in the discharging tube which I see in the drawing; must it be placed there before the vessel is started? And then, how he proposes to discharge two torpedoes, because if there is only one tube——

Mr. NORDENFELT: There are two tubes.

Admiral BOYS: Is one below the other?

Mr. NORDENFELT: They are parallel to one another.

Admiral BOYS: I may also point out that this larger vessel gets to a considerable size, and the actual pointing of the torpedo depends upon the pointing of the vessel. The vessel is actually submerged until she gets within striking distance, then rises to discharge her torpedo, and that appears to me to be rather a difficult point.

Captain CURTIS, R.N.: I should like to supplement Admiral Boys' question by asking how far the submarine vessel must be from the ironclad for the torpedo to strike it, because if it is any distance off at the angle it is laid at, it seems as if it would be likely to go under the vessel. Also whether by its being so close to the vessel would the pressure of the water be likely to compress the submarine vessel. Then I should like to know whether in a rough sea the water does not come through the funnel.¹

Mr. NORDENFELT: There is no funnel.

Captain CURTIS: Does Mr. Nordenfelt contemplate the use of torpedo-nets of any depth in estuaries to counteract the effect of his torpedo-boat? I anticipate the time when ships will not carry their own nets and spars, but will be accompanied by covering ships laden with tubes that will fit into one another, fitted with

¹ I should have said, when not awash running above water in a rough sea, is the sea liable to enter the aperture where the draft is forced through?

jackstays and nets to them. Fleets will be eventually folded, as you would fold sheep, with openings for ingress and egress. If a ship is to carry all the torpedo-defence gear that I understand they have in present use, perhaps some younger Officer, who is more acquainted with the subject than I am, will tell us how long it will take to get a ship ready for action in case the fleet is suddenly attacked when off a port. For my own part I think it will take some considerable time under such circumstances to prepare for action.¹

Admiral GORE JONES: His Royal Highness has touched upon the fact of the torpedo-boat being very likely to get too close, and has suggested that something in the shape of nautical cocks and hens or fish were to be put up to test that. Now I can state from actual experience that that has been actually tested in America. Experiments have been tried in New York with crates and crusher-gauges and other appliances to find out how far the different explosives would act at different depths and distances, and on one occasion when these experiments were being tried a large school of porpoises was seen approaching. The Officer waited until the porpoises were within 200 yards of the 200 lbs. of dynamite, and then fired it, and in an instant the whole school of porpoises were up in the air, going round and round like flying fish. Three dropped dead on the water and the others were lying helpless and were secured for oil. This will show pretty clearly what the tremendous effect of a large explosive charge in water would be, and I mention it as a practical thing that has been tried. Not that I am at all afraid of a submarine boat getting too close to the enemy. If a small boat blows up a big ironclad I think she will have expended her life most happily. I am not at all afraid of it. But if they do get too close there is no doubt there is a great danger, as His Royal Highness has pointed out. With regard to the submarine boat, I really know nothing about it, and therefore shall not attempt to speak upon it.

Major-General HARDINGE STEWARD, R.E.: I had the pleasure of seeing this experimental boat tried in Sweden in the autumn of last year, and, on the whole, I think almost all the Officers were very much impressed with it. We saw it on the last day of the trials, under the most unfavourable circumstances possible—that was in a dead calm. The water was as smooth as glass, and a Spanish Torpedo Officer who was on the yard-arm said he could see the torpedo-boat approaching at a distance of 500 metres. He made a great point of this, but the boat was running near the surface, and its general position was known, so I think you will all agree with me that the precise case may not occur again. The boat was a small boat, but I understand that Mr. Nordenfelt has designed a larger one. Since I saw the boat, torpedo tubes have been added to the bows, and I do not see any reason why they cannot be very well used. Some speakers have referred to the danger that may arise by the explosion of a charge of dynamite under water while the boat itself is under water, but I do not apprehend any danger at all. I have been assured by an Admiral now here, that on one occasion when a small charge of 60 lbs. of gun-cotton, such as would be used with the Whitehead torpedo, was fired at Portsmouth, a diver was accidentally below water and within 100 yards of the charge, and nothing happened even to the glass eyes of the helmet, though the diver felt the vibration of the water. The charge which destroyed the porpoises, and which Admiral Gore Jones has mentioned, was I expect a large ground mine fired by the land engineers. I was very pleased to hear what Admiral Arthur said about boats of the kind now under consideration being used principally for running *on the surface*, and I hope that that will be their future rôle. It is all very well to say that you can do a great deal of business with an ordinary torpedo-boat that runs 20 knots, or even with the second class boats, but unfortunately we have not got enough of these boats. If under fairly favourable circumstances you are going to attack vessels lying in the offing a few miles from the entrance of a port, you must expect a loss of 30 per cent. of the boats you use; that means that if you take five

¹ I am of opinion that merchant steamers should be laden with torpedo defence materials and accompany fleets; when they come to, off the enemy's port, working parties from each ship should be sent on board to get their portion of the defence material and fix it where required—"Nets break a heavy sea."

you may lose two, and if you take eight you may lose three, and even then you run the chance of being beaten off. But, as a member of the Council of the Naval and Volunteer Defence Association, I have to consider with others the defence of commercial harbours, and I have also to deal with the defence of Colonial ports. I am in a position to state that many of our ports do not possess even the proportion that is to go to the bottom. It comes to this, that if you want to economically defend a port, it is better to have a boat that does not show at all. Then, another thing one must remember, and that is that the moral effect of this boat would be enormous. I am perfectly certain that foreign war vessels would not lay off a port to intercept outward and homeward bound vessels if they knew that there was a submarine vessel inside that could come out without being seen. I certainly think that 10,000*l*. would be very well spent in providing a vessel of this class.

Mr. ANDERSON, C.E. : I am afraid I cannot say anything of interest on this subject, except to state that it is well known, through the late Mr. Froude's investigations, that a fish-shaped vessel under water is in much more favourable circumstances for obtaining high speed than any vessel on the surface of the water, because it is established theoretically that a vessel of easy lines completely submarine meets with no resistance at all except the skin friction of the water, no resistance, I mean, such as that which arises from the bow wave, and therefore I believe that if Mr. Nordenfelt will apply a little more ingenuity and perseverance to the perfecting of his boat, the result will be the attainment of a very high speed under water, and consequently a most formidable vessel. It seems to me also that the precaution which Mr. Nordenfelt has taken against the danger of the vessel continuing to sink, as it would naturally tend to do in consequence of the contractions of volume due to the increased pressure arising from increasing depth, will be found to constitute the cardinal features in submarine boats.

Mr. NORDENFELT (in reply) : His Royal Highness has drawn attention to several very important points which I could not very well put into the lecture, and upon some of which I, not being a sailor, must speak with a considerable amount of diffidence. To begin with, as to the question of resistance—the difference of resistance when going below and when being on the surface—in a submarine boat the resistance differs so much from that in a surface boat that I should like to draw attention to it. In the first instance, in my boat the additional surface immersed when it is under water to that which is immersed when she is running awash is extremely small. In an ordinary surface boat the portion immersed is very small, but the portion above is comparatively immense, and if you go down another foot you increase the surface friction tremendously all along the boat. In my submarine boat you increase it very little, as it is only the small top of the turtle-back which is out of water when the boat is on the surface. As Mr. Anderson is good enough to say, I believe it is absolutely proved that with this sort of lines the speed below for a given consumption of fuel to a given boat must be greater than the speed above. The factor of safety of course is manifold. Safety as against general risks of seamanship, of being struck or striking the bottom, or anything of that kind, I have endeavoured to ensure by making the boat very strong and also by the fact that if my machinery fails I float up. As long as my regulator acts I cannot go below the point at which it is set, and then I have a very large proportion of water which I can blow out under high steam pressure by simply turning a couple of handles. I quite believe that by degrees we may find means for increasing the factor of safety, but I think for the present that is sufficient. Then as to the risk which a boat would run in discharging a torpedo against a ship. I am not aware that anybody has fired Whiteheads from a submarine boat. No doubt the boat which sank the "Housatonic" went down with her, because carrying nothing but a spar torpedo she had to run close up to the attacked ship, but now when you fire a Whitehead you can of course determine the distance which you consider safe, and I hope the English Government, or any other Government, will carry out systematic trials to determine that point, probably arriving at the conclusion that a Whitehead carrying from 30 to 60 lbs. of gun-cotton must not be fired at a shorter distance, say, than 50, or than 100 yards, and that a torpedo like my controlled torpedo, which will fire 300 or 400 lbs., must not be fired within 300 or 400 yards. My controlled torpedo can be steered, but the Whitehead is not steered, and they will have to

determine at what distance a Whitehead cannot miss the side of a ship ; I should say at 200 to 300 yards. I therefore consider that a Whitehead can safely be discharged from my boat, but I speak of course under correction, depending upon trials to come. I hold that I can always stop the boat in time, because during the last 1,000 yards if I run from 3,000 to 1,000 awash, and at the last 1,000 yards if I run below I know my speed, my number of revolutions, and my time, and I ought to be able to calculate the distance so far to a certainty that I cannot come within 200 yards. I should know the time it takes a certain given number of revolutions to move the boat about 800 yards. If, however, there are very strong currents where I cannot control the boat, I can always at the last moment run up to the surface and fire from there. One Officer spoke about the effect of having a fixed angle for firing. The angle need not be fixed, because I can have a screw to raise one end if I want it, but generally 10° to 12° is the angle given to a torpedo, as I fire under water and at short range 4° to 5° will probably be found sufficient. We might be at a longer distance than I meant to fire it ; in that case it would be safer to have the torpedo laid at a smaller angle. If I do not feel certain of my position I can always come up, see where I am, and if I am too near go down to retire, and if too far either fire where I am or go down and advance. The net, I believe, is supposed to hang 30 feet down. Of course an ordinary Whitehead could not be used when the ship lies still, supposing the net to be efficient. If a ship moves, or if a number of ships move together, I do not suppose they would have the nets, and if they moved in narrow waters they certainly would not carry nets, because of the difficulty of steering. I suppose a number of ships together would not move at much more than 7 or 8 knots, and in difficult water, at 7 or 8 knots, the nets down would very seriously interfere with the steering and cause risk of collisions. However, I do not want to be brought to-day into the net question. If a ship lies still with a net which keeps off the Whitehead, of course my Whitehead is kept off in the same way as a Whitehead fired from a surface boat ; but if I fire one of my own controlled torpedoes, which weigh 4 or 5 tons, with a striking velocity of 15 miles per hour, the inertia must necessarily either tear the net to pieces or bring the net so close to the ship that the very heavy charge of dynamite will have its effect. As to the danger of the discharge of the torpedo doing harm to the submarine boat, the effect of the explosion is generally up and down, and its horizontal effect is very much smaller. I am speaking generally, as I have not before me the figures of any actual experiments. I am certain, however, that the horizontal distance at which a submarine boat would be safe is very much smaller than one imagines from the general effect dynamite has against ships. If a dynamite charge is exploded 50 or 60 feet out, the effect upon a ship would be very slight ; I believe you have to get so near that this angle of effect in water strikes the ship almost directly upwards, or at very short distances horizontally, otherwise the effect would be very small. But I say this, if the Whitehead when carried by my boats cannot pierce a net, I should be as bad in this respect as the Service boat, but not worse. I should think the trials as suggested by His Royal Highness could very well be made. You can enclose animals in something which has exactly the same strength as my submarine boat, then fire your torpedo at 100 yards and see the effect upon them. You can in that way very easily find out at what distance the torpedo would be dangerous, and then Officers and men would be trained not to run the boat nearer than the limit of distance thus determined. I believe that Professor Abel has already made a number of experiments to determine the strength and direction of the effects of these explosions. I can, of course, make a boat with a very much larger reserve of buoyancy when going down than I have at present. I have the reserve buoyancy very small, in the first place because the boat being thus more sensitive I can control her better ; and, in the second place, because whatever buoyancy I have I must have my horizontal propellers strong enough to pull down against it. If I have these propellers much more powerful it means that I consume so much more steam for that purpose than I do now, that is, I diminish the distance for which I can use stored steam to drive my boat, I lose some of the steam in holding myself down that might be used for going forward ; but in the 100-foot boat of course there is a tremendous superabundance of steam, and very likely it will be found I can have the horizontal propeller so strong that the safety will be very much increased. Sir

Cooper Key referred to Mr. Scott-Russell's boat. I am very sorry I never heard of it, if I had, I should have mentioned it; but I should say that the form of an inverted open ship of course takes away all possibility of surface speed.

SIR COOPER KEY: It was simply a large diving bell.

MR. NORDENFELT: It takes away the possibility of living in a bad sea in hard weather, and also the possibility, which I look upon as a most important matter, of being able to run 100 miles or so in a night previous to the attack. It brings the question back to what Admiral Arthur said was the old idea, to have something which went down and did its work, without actually providing a means of running a long distance before that time. I believe that in making use of submarine boats to replace surface torpedo-boats, the long previous surface run is absolutely necessary; you cannot do without it. I fully admit the value of Sir Cooper Key's prediction, that I shall soon give much greater surface speed to this class of boat. The two boats now building will give fully 12 knots per hour, and if, as General Steward proposes, these boats are used to move and to fight "awash," and are not to submerge entirely, except for the purpose of safety if detected, I am quite prepared to lengthen the boats to 130 or 140 feet, and to give them 17 knots surface speed, when the small cupola would run very little chance of being hit. About the speed below I cannot be wrong; anyhow, it can easily be found out. I have not made any real under-water speed trials, and I do not mean to do so. I do not think it is fair to call upon my civilian employes to make trials, the risk of which I cannot previously ascertain; that will be done safely by degrees by some naval Power who can afford such trials. Admiral Arthur mentioned that the boat will be very useful when she runs awash, and he went still further and said probably she would never be used otherwise. I should like nothing better than that the boat should be used awash; I mentioned in my lecture she would be very often so used, but I still feel that if I had come before you and said only, "I have a boat which shows very little above the surface compared to other boats," you might not have come to listen to me, whereas, when I discuss a boat that actually has gone below, you are good enough to come. I also feel that although a good deal of work will be done awash, still if, as I believe, when an enemy comes too near me, if I am not in a position to attack him, it is a very important fact that I can go down 15 or 20 feet, and lie at the bottom in shallow water until it gets dark, and then come up again. In the large boats the men can live about 10 or 12 hours without outside air. In carrying Admiral Arthur's idea a step further, and in looking to the probability of some of these boats being used exclusively as surface boats, with only a small portion of their turtle-backs showing out of water, I can easily see how extremely useful they would be as scouts. With their smoke blown out under water as I do already now, and with 15 to 17 knots speed, they would be the very best and safest scouts that can be constructed—they would fulfil a great want for keeping the touch of the enemy, report its movements, and generally act in supplying news to the Naval Intelligence Department in the flagship. This is a most important service for which secrecy of movement is of great value, and which cannot be done as safely or as well either by launches or by the surface scouts, whose chimneys and smoke reveal their existence and movements at very long distances. I believe Admiral Boys asked a question about the depth of water; what I would propose would be this: the Captain ought to know the depth of water, and if it is more than 30 or 40 feet, he will have to watch carefully the security-regulator. If the depth is not so great, he need not watch it at all. You can go clean down and not stop till you get to the bottom; then of course you cannot advance because of the friction of the bottom, but you have always full control over the boat. I hold very strongly against the old idea of getting so near a ship as to go under it, or letting go anything that floats up to its bottom, or endeavouring to project anything at a short distance, with the idea that it should affix itself to the ship. It is all very well with a wooden ship if you can sew a wire into it, but not with an ironclad. It would bring in such a tremendous factor of uncertainty, that I would not like to take it up at all. As to the light, we have never been down more than 16 feet, but at that depth there is plenty of light from the surface of the water. The mirror of the surface throws a very strong light inside the boat. You cannot see fore and aft except at the angle, at which the water above you, acting as

a lens, reflects objects on the surface. What that angle is I have not ascertained absolutely, but it is a tolerably large angle. You cannot see far forward at all, and you cannot see far astern, it is as black as ink, you can only see a sort of segment. You cannot see forwards, that means that you cannot safely advance at great speed under water, that holds at least until it has been proved to the contrary. It is impossible to think of a submarine boat as a boat that actually manœuvres and does its work under water; I gave that up from the very commencement. I do not believe for a moment that a man can go down and steer about for great distances, and attack right and left; the risk is too great. He should run awash and then he would see where he was. Off Landskrona it blew like furies and every wave went clean over the cupola. The boat went close round the "Osborne," and between her and the Swedish "Edda," and manœuvred perfectly, so that there is no trouble in seeing when you are awash; it only requires training. That is the position in which I would like to move about and do the work, and not till I was so near that I could be seen, would I go down. Of course, I would not attack in brilliant daylight, and I would not attack quite alone; I would send some boats on the other side of the ship, or do something else to create a diversion. I do not admit that I can only attack a ship that lies still, because as I can move awash at fully 12 knots with my large boats, I can follow up the movements of any number of ships blockading or bombarding. I do not believe that any squadron afloat ever manœuvres under fire faster than 6 or 8 knots when blockading or bombarding; at any rate I am not tied to attack only stationary ships. Then about discharging the torpedo; there are the tubes, one above the other.

Admiral FREMANTLE: Is the torpedo protected?

Mr. NORDENFELT: Oh, yes, in regular tubes. There are two ways of doing it. With the small torpedo, and the mode I have indicated of attacking, I always mean to be nearly abreast when I discharge, crawling forwards; when I do fire I am practically still. I therefore have a number of openings, especially towards the rear part of the tube, which let in water. There is water in constant communication with the screw of the Whitehead, and therefore I require no propelling power, other than its own screw, for discharging the Whitehead. It has been proved by the French Government that Whiteheads can discharge themselves out of tubes if water is provided, even at a resistance of $7\frac{1}{2}$ to 8 knots speed. As I never imagine that I should fire at speed under water in that boat, I discharge it simply by her own screws. Also in the larger boat I propose to discharge them simply by their own screws, but there is no reason why I should not apply steam for discharging, not letting the steam act directly upon the Whitehead—because I would lose so much steam by the condensation—but by acting upon pistons which press upon water and the water to drive the torpedo out of the tube. That is, however, a complication which at the present time I have not thought necessary to use.

Admiral BOYS: How do you propose that the crew shall get air?

Mr. NORDENFELT: We had at Stockholm four men absolutely locked up for six hours.

Admiral BOYS: Where do you get the air?

Mr. NORDENFELT: In the boat. The actual cubic space in the small boat is sufficient for four men for six hours, and not only enough for six hours, but you could not measure the diminution of the length of the flame of a tallow dip that was down at the bottom of the floor, whereas the men are higher up where there is less carbonic acid and less impurity in the air. I hope that with the interest which has been shown in these boats—three of which have been already purchased from me—we shall be able to bring to bear upon the subject the intelligence and great experience of naval Officers, and by that means get over a great many smaller points that I feel can be easily settled by lengthened experience. When that is done I believe the boat will be very much better appreciated than I as a mechanic can possibly make it in its early stage.

The CHAIRMAN: Your Royal Highness and gentlemen, it is past the usual hour at which these meetings close, and even if I felt inclined, I should not detain you by any remarks of mine. I had the opportunity of seeing this boat on the Swedish coast, and of being present at the trials. I have also had to report to the Government the result of these investigations, and without saying whether that

report was favourable or not, I will only say from the criticisms that have passed—especially from the distinguished naval Officers who have addressed this meeting—that if my report has been a favourable one I have not erred in their opinion. I think the highest compliment which I can possibly imagine to Mr. Nordenfelt and to this invention was the criticism which we heard from the most distinguished scientific authority in the Navy of the present day—I mean Sir Cooper Key, who apparently entirely accepted the practicability, the security, and safety of this vessel, and whose criticism was limited to the question of speed. I think that shows that evidently, as far as practicability for warfare is concerned, this submarine boat is pretty well accepted by the profession. The only other observation which occurs to me is this. I do not myself attach such very great importance to this invention as a powerful means of submarine defence in English waters. I believe we have a great deal to learn in this vessel with reference to overcoming tidal currents and currents when submerged. In smooth calm waters where there is an absence of tide and current, I believe it is a very formidable machine, and although General Hardinge Steward alluded to the facility with which this vessel was seen in a glassy sea, I can only say that when there was the slightest ripple on the water at distances of 200, 300, and 400 yards, it was very difficult to distinguish. Therefore, as a craft not altogether wholly submerged, but just a boat awash for coast defence and also for the attack of ships at sea, and especially in heavy weather when the fast torpedo-boat cannot act, I believe this vessel will be found of great practical and reliable service. I will not detain you longer, but will ask you to give me permission to convey our best thanks to Mr. Nordenfelt for his very interesting lecture.

Friday, February 12, 1886.

COLONEL SIR LUMLEY GRAHAM, BART., Vice-President, in the
Chair.

SOME SUGGESTIONS AS TO THE BETTER TRAINING OF OUR INFANTRY.

By Major C. ARUNDEL BARKER, 2nd Battalion Royal Irish Fusiliers.

The CHAIRMAN: Ladies and gentlemen, I have to introduce to you Major Arundel Barker, who is going to read a paper entitled "Some Suggestions as to the Better Training of our Infantry." Major Barker is an Officer of considerable regimental experience. This Institution always specially welcomes regimental Officers who speak upon questions connected with their own duties. It is, I believe, the first time that Major Barker has given us a lecture, but, having read it, I know that it is an interesting one.

THERE can be no doubt that our present system of training our infantry soldiers, both at home and abroad, but more particularly in the former case, is considered very unsatisfactory by all Officers who take an interest in their profession.

Even granting that the system was everything that could be desired in the case of regiments at home—and it is those only that I propose to consider in this paper—there would exist grave difficulties in carrying it out.

In the first place, their establishment—except in the case of regiments shortly about to go abroad—is very small, and owing to the short service system they must contain a large proportion of recruits. When in addition to this it is remembered that they have to furnish large drafts every year to the battalion abroad, and that numbers are daily taken away for duty, regimental or garrison employ, and for the various classes of instruction which are so numerous now-a-days, it ceases to be a matter of surprise that there should be no men left to learn that preparation for the time of war which should in reality be the end and aim of our whole system.

It is a fact, that out of a regiment with an effective strength of over 600 I have seen a Commanding Officer's parade where the band was stronger than the whole of the rest of the parade, and where there were hardly as many privates as there were Officers.

Now, the objects which I propose to set before myself are:—1st, How are we to get a sufficient number of men to teach anything to? and, 2nd, What are we to teach them? on the old principle of "first catch your hare and then cook it."

Although the Military Prize Essays for 1885, published in the Journal of the Royal United Service Institution, do not refer directly to the depletion of regiments at home, yet indirectly they bear upon it in a very important manner. If the recommendations made by the majority of essayists are carried out—as undoubtedly they will be to a greater or less extent—the time for which a soldier engages to serve in India will be considerably extended, and therefore fewer men will be required each year to replace the loss occasioned by men who take their discharge or are transferred to the reserve. At present a regiment, whose linked battalion is in India, has annually to send out a draft of some 150 men, and the drain this causes upon a home strength of only 560 privates may easily be imagined.

If by extension of service in India this annual drain be reduced, regiments at home would, of course, have considerably more men left for drill purposes.

Again, a large number of men, especially in garrison towns, are taken away for guard duties, and when this is the case they are not, as a general rule, available for morning parade for two days in succession. The duties on guard are very easily learned, and it is not necessary that a man should go on guard once a week or oftener to keep up his recollection of them. There is no duty which a soldier dislikes so much or which tells in such an injurious manner on his health. It is quite certain that guard duty is one which contributes more than anything to lessen the popularity of the Army, and yet numbers of guards and sentries are mounted every day which could, without the slightest inconvenience, be abolished to-morrow. Cannot we take a lesson from civil life in this matter? Does a manufacturer, for instance, who has a large amount of valuable property lying in his yard post sentries over it? Not he! He considers he has taken ample precautions if the premises are locked up at night, and a watchman makes an occasional round. But not content with posting sentries over everything which can or cannot be taken away, we put whole guards in places where the work would easily be performed by at most two men. At every military hospital, for instance, is a guard. What for? The main reasons, as stated in the order board, are to prevent any improper articles from being passed in to the patients, and to keep the latter from leaving the premises. But round nearly every hospital is a high wall with a gate, where a single man on gate-duty would answer all purposes.

It may seem something like high treason to doubt the necessity of a barrack guard, but I think that an inlying picquet, occupying the guard-room at night, but allowed to go to bed, would fulfil all requirements, and would only take men from parade for one day instead of two.

The number of orderlies, too, which have to be furnished by a regiment appears excessive. In a large garrison town where there are several regiments I have known as many as twenty-five taken daily from one corps. In these days of frequent posts, telephones, &c., much of the work now done by orderlies might be relegated to them; and though Staff and Departmental Officers might be unwilling

at first to part with men who are a convenience in many ways, they would doubtless soon come to see that it was for the public advantage.

The gymnasium and great gun drill also often take a number of men away from parade. Would it not be possible so to arrange that these should be mainly carried on in the winter, and only in the afternoon or evening in summer, so that a Commanding Officer might, at any rate, have his men to himself for the whole morning in the drill season?

Winter is the time in which we get most of our recruits, and as much as possible of their preliminary training should be got through before the summer commences, but a great deal of time is often lost in bad weather owing to there being no covered place to drill them in. This difficulty could and ought to be met by having a drill-shed—it need not be an elaborate one—in every barracks.

Another plan for getting a respectable number of men together is not so much resorted to as it might be, *i.e.*, early morning parades. In the first place, one can have all the men about to go on guard, and, secondly, the orderlies, tailors, shoemakers, subordinate clerks, &c., who need not as a rule commence work very early in the day, and to whom, especially for those who have sedentary occupations, an early morning parade would only act as a freshener. But what makes a Commanding Officer hesitate to order these latter to attend parade is not so much the time they would be absent from their other duties, as the time they will take to clean their accoutrements afterwards.

By substituting brown leather for buff and adopting a button which does not require constant polishing, the waste of time incurred by the occupation aforesaid might be reduced by one-half.

Lastly, it is evident that the more simple and easily learned a recruit's drill can be made, the more quickly will he be able to take his place in the ranks, and the more time he will have available for practical training; but I will only touch on this subject here as I propose to go into it more fully later on.

Now, having tried to show how a certain amount of the raw material might be obtained, it remains to consider how it is to be worked up.

If any one who has taken the trouble to listen to the preceding remarks imagines that the object of all this is to turn out an ideally smart regiment, one that can advance in line like a wall, and execute all the most difficult manœuvres in the "Field Exercise" to a hair's breadth, he is very much mistaken. The single aim I have set before myself is that to which I have alluded before, *viz.*, to make the soldier as efficient as possible in time of war, and in all that follows I have tried to keep this object steadily in view.

Not long ago appeared a small book entitled "The Fighting of the Future," by Captain, now Brevet-Major, Ian Hamilton, which strikes the keynote of what our system of training ought to be. There is no doubt whatever that he is perfectly right in his contention that a soldier who has been so trained to handle his rifle that he is perfectly confident that he can hit anything, whether stationary or moving, at a reasonable

distance, is worth half a dozen of our present ordinary rank-and-file. I would wish nothing better than to see the system of musketry training which Major Hamilton advocates adopted in its entirety; but it would be perfectly impossible to carry it out unless there were a rifle-range within easy distance of every military quarter in England. This means a very large expenditure of money which it would be hopeless to try to get out of the British taxpayer unless a sharp defeat sustained by our troops should bring home to him its necessity, so that for the present we must be content to hope for better things and make the most of what we have. There is a great difference between various stations as to their suitability for carrying on musketry instruction. At some the rifle-ranges are quite close to the barracks, and would permit of the men going out to shoot at any hour of the day; at others they can only be reached by a march of four or five miles or by rail. At the former places a more extended course of musketry, on the general lines laid down by Major Hamilton, might be provided for, with, of course, a larger allowance of ammunition, and these stations might be reserved for regiments first on the roster for foreign service.

Again, when on account of the paucity of troops in England—as during the late war in Egypt—or for other reasons, it is possible to choose between two stations, preference should be given to that which offers the greatest facilities for musketry instruction. It is impossible to turn out first-rate shots without plenty of practice on a range, but the introduction of Morris's tubes has opened a great future to the improvement of rifle shooting. Ranges for these may be made anywhere and at very small cost, and no barracks should be without them. A certain amount of ammunition, say 200 rounds per man, should also be provided by Government, for some men take no interest in rifle shooting, and they cannot be ordered to shoot with the Morris's tubes at their own expense. Practice with these tubes does not teach the soldier to make allowance for the wind, or to meet the recoil of his rifle, but these are not hard to learn, and I am persuaded that by their constant use the shooting of bad or indifferent shots might be improved fully 50 per cent. Moving, and appearing and disappearing targets can quite easily be arranged at very small expense, so that every description of shooting can be provided for.

Nearly every change in musketry instruction of late years has been in the right direction; but regimental Officers—and they certainly ought to know best—are almost unanimously of opinion that the abolition of musketry instructors is a mistake. It is perfectly right and proper that Officers commanding companies should put their own men through the annual course of musketry, and most of those I am acquainted with, would not wish for anything else, but the want is much felt in regiments of an Officer whose business it is to look after the whole department of musketry instruction.

Under the present system, *vide* "Book of Musketry Instruction," the responsibility is divided between the Commanding Officer, the second in command, Officers commanding companies, and the Adjutant; but "what is everybody's business is nobody's business," and when

anything special has to be done, such as arranging rifle matches, or the selection of teams for rifle meetings, &c., there is no one who feels that he has any responsibility connected with it.

The special object of a Captain is to get his own company to shoot well, and it is not in accordance with human nature to expect him to take the same pains with casuals, who may, perhaps, belong to a company he is trying to beat, as with his own men; but the ambition of a musketry instructor is that the whole regiment should have a good figure of merit, and the casuals might safely be left in his charge. Besides which it is notorious that the training of non-commissioned officers and recruits, the supervision of markers, musketry fatigue parties, and care of ranges, are not as efficiently carried out under the new arrangements as they used to be. The way in which the figure of merit of a battalion is calculated, has varied so much in the last few years that it is difficult to compare the shooting of one year with that of another, but it is a matter of general opinion that the shooting of the majority of regiments has fallen off since the abolition of musketry instructors, and this too at a time when not to go forward, is to go backward.

I have placed musketry training first in the order of things to be taught to a soldier, and urged that our troops should be quartered, as far as possible, in places where every facility exists for carrying it out; but fortunately such places will generally be found best adapted to what comes next in importance, viz., his training in all duties in the field. For this purpose the barrack square, which is in many places the only provision, is almost worse than useless, for all the conditions are as different from what is likely to be met with in actual warfare as they well could be. Instead of practically unlimited space with every variety of ground, is a miserable plot, perhaps 200 yards long by 100 broad, level as a billiard-table, and inclosed by high walls.

If anything more than elementary drill is attempted, such as outpost duty or the drill of attack, the proper intervals have to be sacrificed, and Officers and men get into a cramped and finicking way of working. The fact is that for every 100 yards further that the rifle carries, we want a proportionate increase of space in our drill-grounds, and though 200 yards might have been quite sufficient for the Brown Bess, a mile and a half is not too much for the Henry-Martini.

It is much to be regretted that the Government has so few large spaces permanently at its disposal for camps of instruction. Aldershot and the Curragh are excellent in their way, but only a small proportion of our troops at home can be quartered in them. If additional camps were formed in places where they were most wanted, such as in the midland counties and the North of England or South of Scotland, many regiments now quartered in the heart of densely populated towns might be sent there, and the sale of the land on which the barracks stood would probably cover the cost of the purchase of such waste lands as are best suited for a camp, and of the erection of huts for troops upon them.

An incidental advantage of these camps would be that they would

afford increased opportunities for our militia and volunteers to work in connection with the regular troops.

The month's course of military training of soldiers instituted in 1883—which I may briefly state provides for instruction in attack and defence of positions, outposts, advance and rear guards, escorts, hasty entrenchments, duties in camp, the elements of military bridging, &c.,—is very useful, but unless large areas such as I have mentioned above are available, it cannot be properly carried out. Another thing which goes far to do away with its good effects is the ridiculously small number of men which a Captain frequently has at his disposal. How can outpost duty or the drill of attack be done properly with fifteen files? Yet that number is by no means uncommon. To remedy this, I would suggest that a whole wing of a regiment instead of one company should be struck off duty for a month, the company going through the annual course of musketry, and all duty men, orderlies, &c., being taken from the other half battalion, which might easily be done if some of the measures recommended in the early part of this paper, were adopted.

For the first week companies might be left to their own commanders, but for the remaining three they should be worked as much as possible together, under the command of the senior Major or Captain. In this manner there would be a sufficient number of men to furnish two parties to manœuvre against one another, and to carry out outpost duties, &c., in an intelligent manner.

No larger provision of tents or entrenching tools would be necessary, as the companies could use them in turn. It would be a great assistance to Officers when lecturing to their men, if a set of illustrations of hasty fortifications, knots for military bridging, &c., were provided for use in the lecture room.

Now, supposing that a regiment in which every available man was kept in the ranks, was quartered in a station close to a rifle range, and with plenty of open ground in the neighbourhood, how much time should be devoted to those barrack yard manœuvres which now form the principal serious occupation of the soldier? I emphatically say—and I am by no means the first to say it—as little as possible. They are only means to an end, and as long as that end is attained, the simpler the means the better. Besides which, a man who has always been accustomed to feel a comrade touching him on either side as in ordinary drill, is apt to lose confidence in himself when fighting in the loose order necessitated by the precision of modern firearms, and only constant practice in extended order will ever make him self-reliant. A certain amount of drill in close order is of course necessary for the line of march and for the preliminary movements of a battle; there are also certain exercises in the use of the rifle which are absolutely necessary, but the two principal books “published by authority” for infantry, contain a good deal which is of no practical use in time of war. As the soldier would have quite enough to keep him fully occupied in other ways, I propose to glance through the books above mentioned and try to find what might advantageously be omitted. We will begin with the smallest, the “Rifle Exercises.”

Turning to this, we find the first thing taught is the "manual exercise." In the book before referred to, "The Fighting for the Future," Major Hamilton condemns, as it appears very justly, the first movement in this exercise, the "Present arms." He contends that it takes a long time to learn and is quite unnecessary, since if the "Shoulder" is good enough as a salute for a Captain or a subaltern, it is also good enough for Officers of superior rank, giving as an example, that in civil life a man makes no difference in his salute between a noble and a commoner.

No one will pretend that the "Present" is any use in war, and if we can do without it in peace, it is a pity to retain it at all.

The next thing we arrive at in the Rifle Exercise, is the Funeral Exercise, from which the "Reverse arms" and "Rest on your arms reversed" might easily be omitted without detracting anything from the solemnity of the occasion.

The 8th Section is "Preparing for cavalry," which it is thought might be left out as a separate exercise altogether. Bayonets can be fixed at any time, and the front rank now always kneels at the command to fire. Placing the butts of the rifles on the ground renders them useless for firing purposes for the time being, and though every writer on tactics, at the present day, demonstrates the impossibility of unbroken infantry being successfully attacked by cavalry, in this exercise it is assumed that cavalry will be able to approach so close that it will need a regular fence of bayonets to keep them off.

The following Section, No. 9, is the "Feu de Joie." Here again is an absolutely useless exercise which requires a great deal of practice, and therefore takes up time which could be much better employed. Firing volleys by companies from right to left and back again from left to right, would be quite as effective, and would require no additional training. Lastly, comes the Bayonet Exercise, which, though of very little use for the purpose for which it was originally intended, may perhaps be retained as a good gymnastic exercise, strengthening the arms and generally exercising all the muscles of the body.

In the same volume as the Rifle Exercises, is Musketry Instruction, but this certainly does not err on the side of containing unnecessary matter, and is, besides, in process of being rewritten, so we will now pass on to the Field Exercise. The first part of this book is devoted to those elementary movements which have to be learned by all recruits before they can take part in company or battalion drill, and there is very little here which can be omitted, but I think the balance step and the slow march are both superfluous. A man can be taught to walk properly without making him stand on one leg whilst he pokes out the other backwards and forwards, and the slow march is evidently not required for anything but show.

In company drill also there is not much to find fault with, as almost all the different movements would be useful on service, with the exception indeed of marching past, but this, in spite of the enormous amount of time wasted over it, can hardly be dispensed with, as it possesses certain advantages of its own, and is the cause of much innocent amusement to the British public.

Countermarching, now that ranks can be changed at will, ought to die a natural death.

In the formation of a company in extended order, are given no less than seventeen bugle sounds for as many different movements. These take a long time to learn, and indeed never are learned by men who have no ear for music. I speak feelingly on this subject, for after eighteen years' service I do not know them all now. But at page 211 it is expressly laid down that calls on the bugle are liable to be misunderstood, and should seldom be used except for purposes of drill, while at page 227 we are told that during the advance for the attack there should be no bugle sounds. The question is obvious, Why have them at all? And indeed I think that the principle of teaching men to do a thing one way at drill and another way before the enemy is a most dangerous one, and the very way to throw them into confusion at the critical moment. Some bugle sounds are useful for many purposes, and we could not well do without them, but I think that the following, *i.e.*, the Advance, Halt, Fire, Cease fire, Alarm, and Charge would be found sufficient.

It will probably be alleged that with the long distances between the extended line, supports, and reserves, it would be difficult to communicate a command to them all without bugle sounds, but this can be done perfectly well and in a far more soldier-like way by a system of signals, some of which are already given in the Field Exercise, and which only require to be supplemented by one or two more. I have never seen this system applied to a regiment, but I have worked a company with extended line supports and reserves in this manner, and found it answer admirably.

Coming now to Battalion Drill (General Rules), I have no hesitation in saying that the sooner mounted Officers cease to be employed in giving points the better. To begin with, we are told (page 106) that directly the battalion comes within range of the enemy's rifles they are to dismount, and I presume they will not be required to give points then.

In the second place, I have never observed that a regiment drilled by the Adjutant, or sergeant-major, drills worse than when there are mounted Officers, and indeed my experience is that they drill better without them. At brigade parades, mounted Officers are a continual nuisance, as they are always getting in the way and preventing the markers from seeing when they are covered.

With regard to the various battalion and brigade exercises contained in Parts III and IV, it is thought that all might be omitted which come under any of the following heads:—

1. Those which are of no practical use.
2. Those that can be done more simply another way.
3. Those which were originally intended to be carried out under fire, but which are now—owing to the precision and rapidity of modern firearms—quite out of the question.

Under the first head I have classed the following:—

(a.) All movements in half-column (page 133) double companies, and in direct echelon of companies (Part III, Sections 33 to 35).

Half columns are never used by any chance, and though double company formations take up a great deal of room in the Drill Book, surely two companies could, if necessary, act together without necessitating such movements as "Forming line to a flank from columns of double companies," and "Advancing in double fours from the centre."

The original intention of having battalions in echelon was to enable them to protect their own flanks, or the flank of the brigade, according to circumstances. This would now be effected by having a company or a battalion in attack formation on the flank to be protected. It may be occasionally desirable for brigades in the second line to have a battalion thrown back on a flank, but there does not appear to be any necessity for echelon of companies.

(b.) Most of the instructions regarding the colour party. Regiments are not now allowed to take their colours with them on service, and even in times of peace they are only taken out on very rare occasions; so it would be quite sufficient to lay down rules for the movements of the colour party in marching past and other purely show manœuvres.

(c.) A battalion in line advancing in column from a central company (Section 23—2); and forming column on a central company (Section 25—2); changing front on the march (page 190).

All the above movements are apt to cause confusion, and are never used except for drill purposes.

(d.) A brigade changing front, the whole in echelon (Part IV, Section 16).

This manœuvre to be carried out at all requires a perfectly flat and unbroken plain, and the chances of finding such a place on service are too remote to be taken into consideration.

Under the head of "Movements that can be done more simply another way," may, I think, be placed—

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| (a.) "Advance in column." | } Part III, Section |
| "Open to column: rear companies halt." | |

These can be done in both cases by "Opening to column from the rear company."

(b.) "Break into column to the right, or left" (Section 21—1, 2). Column can be formed from line much more quickly and simply by wheeling the companies to the right or left.

(c.) A battalion in column forming line by companies in succession to either flank (Section 27).

Line may be formed to either flank by simply wheeling to the right or left into line, and it cannot be a matter of great importance whether the order of the companies is inverted or not.

Lastly come those movements originally intended to be carried out under fire, but which are now quite out of the question. These are the most mischievous of all, for it is simply a case of teaching our men "How not to do it."

(a.) Battalions in line relieving one another (Part III, Section 8).

It is now laid down as an axiom that troops once engaged cannot be relieved, but under what circumstances could it be necessary for

regiments to relieve each other in this formation unless they were engaged?

(b.) A battalion in line retiring from one flank in rear of the other, or from both flanks in rear of the centre (Part III, Section 24, and Part IV, Section 12).

In these movements part of the line is supposed to be covering the retreat of the other, but anything more clumsy cannot well be conceived. Imagine at the present day a battalion retiring under fire as above described. It would be a case of getting out of the frying pan into the fire, for instead of receiving the enemy's fire in line, which would be bad enough, it would be exposed to it in deep column, which would be infinitely worse.

(c.) Prolonging the line to either flank (page 161).

The object of this movement apparently was to withdraw troops in action from a part of the line where they were not wanted, and to transfer them under cover of the rest of the line to the other flank. If this were attempted now they would probably suffer very severely during the operation without being able to return the enemy's fire till they had gained the further flank.

(d.) A battalion in line forming square (Section 37) and forming square four deep (Section 38—2, 3). These formations are now admittedly only useful against savages, and even then square would never be formed from line, nor would a four-deep square be formed by the outward wheel of sections.

The only remaining portion of the Field Exercise on which I have any remarks to offer is Part VII, Miscellaneous Subjects.

The first thing here alluded to is the inspection of a battalion, which one would naturally think would lay down some sort of standard for a General to go by in ascertaining the fitness of a regiment for active service, but in the seven pages devoted to this most important subject, the only exercise alluded to which would be of the least use in time of war is the firing exercise.

Prince Hohenlohe, a very distinguished German Officer, has said that the way in which a battalion is habitually drilled depends entirely upon the character of the inspections.

If an inspecting Officer is content with marching past, bayonet and manual exercises, and a few antiquated manœuvres, Colonels of regiments will go on practising these *ad nauseam*, and will only devote an odd day or so to practical work. The "Inspection of a Battalion," as it now stands, seems to lend the stamp of authority to the method above mentioned, and it is thought that it might be rewritten with great advantage.

Section 14. "Guard Mounting and Trooping the Colour" is a relic of the ante-Crimean days when our troops had nothing better to do. It is happily hardly ever practised now, and might safely be relegated to the limbo of defunct ceremonies.

In the foregoing suggestions regarding the simplification of drill, there are probably many faults both of omission and commission, but it would be easy to appoint a committee of experienced Officers to settle these questions, and I have no doubt that their decision would be

very much in the same direction. Even were drill reduced to a minimum, it would in conjunction with musketry instruction and training in field duties afford ample occupation for the whole of the summer months, and the winter should be specially devoted to all those branches of a soldier's education which can be taught under cover. Shooting with Morris's tubes, school, the gymnasium, lectures on elementary tactics, &c., afford profitable occupation for wet days, whilst fine days are available for ordinary parades and route marching. This last might, I think, take place with advantage twice a week, once in marching order and once in drill order. It is not only good practice in marching but tends to keep the men in health.

I will now bring this paper to a conclusion, only remarking that I believe it is quite possible for our infantry as now constituted, to attain a much higher degree of efficiency at a very small increased cost, and I do not despair—if only military men will keep hammering at it long enough—of the country being brought to see that, in the long run, nothing can be falser economy than having to pay for indifference in time of peace by ruinous expenditure in time of war.

Lieutenant-General Lord CHELMSFORD, G.C.B.: Sir Lumley Graham and gentlemen, I think we must all admit there is a great deal of truth in the strictures Major Barker has passed upon our present system of drill and training, and there is a great deal that might be altered with considerable advantage to the Service. With regard to the paucity of men available for drill, there is no doubt that the present system is a terrible drawback to battalions at home. I do not see how it is to be got over so long as one battalion is to be made a feeder to another battalion abroad. I can only assure Major Barker, with regard to his lament over the number of guards and orderlies employed in our different garrisons, that I believe every General who has ever commanded a brigade at Aldershot, or at other camps, has done his best to reduce their numbers, but somehow or other there is a *non possumus* that crops up on every occasion, and no reduction is ever made. I hope Major Barker's paper may be useful in causing some remedy to be found for that very serious evil. With regard to musketry practice, the great object of our training ought to be to make our men shoot better. At the present moment the whole subject is under the consideration of the authorities at Aldershot, General Feilding being the President, and I am in great hopes that the practical men who are considering that subject will be able to devise a system of drill and musketry instruction which will enable us in the short space of time which the British soldier now is under his Captain's command, to improve his shooting and make him a really efficient soldier on active service. With regard to the Drill Book, no doubt at the present moment it does contain a number of manœuvres which are certainly not necessary for active service; but, as one of the old school, I must remind Major Barker, and those young Officers who are anxious to go ahead into the attack formation almost before the recruits really know their right hand from their left, that it is a very important matter to teach men good steady drill first. It is the foundation upon which everything else is built up. If you neglect that and go into that loose system of drill which I know a great many advocate, impatient, and very naturally impatient, of the old Frederick the Great precision which used to be our standard of high efficiency, I quite admit that you may arrive at getting your men to move very rapidly, and bring them up to the higher part of drill instruction in a manner which will apparently in peace-time be satisfactory enough; but if those men are trained during peace-time in a loose manner you will find when we come to active service that they will not move, and will not be as reliable on the move in open formations as they would have been if more attention had been paid to them in the closer formations. You must recollect that our boast in the old Peninsular War was that our men could always advance and attack in line. The

French never could do that. Why? No doubt the character of the individual soldier had something to say in it, but I believe it was a great deal due to the different system of drill. The French habitually drilled loosely, and when you saw them marching or manœuvring, although they got over the ground quickly, they did so at the expense of all steadiness and precision, and in a manner totally opposite to our mode of proceeding. You must remember the attack formation at the present moment requires exactly the same amount of precision and steadiness as did the advance in line of former days. It is in fact much more difficult, and requires thoroughly trained men who have confidence in themselves and in their leaders. I may be doing Major Barker injustice in imagining for one moment that he wants to do away with steady drill altogether, but as one of those who have been brought up under the old system, but who at the same time has always worked the new system with perfect confidence, I would wish to take this opportunity of most earnestly deprecating the idea that by teaching ordinary drill loosely and hastily, good results can be obtained. With regard to inspections, I quite admit the system might be much improved. Too much stress is laid upon marching past, and consequently too much time is given up to practising it. I should like to see an order issued forbidding Commanding Officers of regiments to practise marching past at their ordinary drill parades. At the inspection a march past would then become a test of the manner in which the battalion had been instructed in the ordinary drill manœuvres. There is no doubt that our Drill Book needs revising, and that it contains a good deal which is of little advantage in the training of our soldiers for active service. When, however, as is so generally the case, there is merely a barrack square to drill our men in, variety in steady drill manœuvres becomes almost a necessity, as to go on grinding away at the same movements is very monotonous and distasteful to all ranks. I trust that the authorities will consider the subject matter of this paper, and that some benefit may accrue from the discussion of it in this theatre.

Colonel DAVIES, Assistant Adjutant and Quartermaster-General, Southern District: I am sure we are all much indebted to my friend Major Barker for bringing this very interesting subject before our notice in the excellent lecture he has just given us. On a great many points I quite agree with him, though on some I do not quite agree. With regard to the unsatisfactory state of the present training of the British soldier, I think we must be all perfectly agreed. The gallant Chairman will correct me if I state what is wrong, but I believe that our men get less training than in any of the Continental armies. This can never be improved till the financial authorities at the War Office and the House of Commons itself recognize the fact that more money must be laid out before we can possibly give men the extra training they require. Of course we are desirous to get the men as much off duty as possible, and to see them in the ranks. No doubt in these days of short service it is of the greatest importance that none of the men should ever be out of the ranks, if possible, on field days. I think the guards might be cut down, and I look upon sentries, though no doubt very ornamental, as, generally speaking, very useless, and, I believe, instead of having the regular sentry as we do now, if we had flying sentries, our barracks, hospitals, and magazines would be far more safe than they are at present with a sentry who is obliged to take up his post in one place and is not able to move. There is one way in which they may get more men in the field with the battalions, and that is by arranging for all the public duties to be done by one battalion each day, instead of having a certain number of men taken out of all the battalions, which is the usual plan. Of course the shooting, too, is most important, but there again we are in the very greatest difficulty in this country, because it is almost impossible to get good ranges. I do not agree entirely with Major Barker about wishing to see the musketry instructor revived; I think it is far better that the company should be trained by its own Officers, and I am quite sure that if the musketry instructor be revived it will all fall into his hands, and we shall have the old system, which certainly was not a good one. With regard to the training that came into vogue in 1883, I believe the idea was excellent, but I do not think it was ever fairly and properly carried out throughout the Army. In the first place, the first arrangement was telling the Captains to begin drilling their recruits from the beginning, putting them through the goose step. We know very

well there are very few company Officers in the least suited to this work, and I should have been very sorry if, when I was commanding a battalion, I had found my company Officers devoting themselves to the duties of drill corporals. We know we are fortunate if we have two or three good drill sergeants or corporals in a battalion, and that then the drill of the recruits will be far better carried out under the Adjutant by these sergeants or corporals than in any other way. And I think before the men are handed over to the Captains to train they should be considered perfect in the use of their arms and in the close order drill; then the Captains are the people who, under the eye of the Commanding Officer, should carry out the further instruction of the soldier in musketry, extended order drill, outpost duty, &c. Major Barker says it is better to strike off half a battalion instead of a company. That is not going far enough. In larger stations I see no reason why a battalion should not be struck off duty, because its instruction, to my mind, should be carried on entirely under the eye of the Commanding Officer, who should be out every day, and all day, seeing what his Captains are doing, not interfering with their training, but giving them every assistance he can by suggesting schemes to work upon, and pointing out any mistakes he may think they make, and taking care that the whole battalion is tarined on the same system. I think if that could be carried out there would be a great deal of good work done, which I am afraid has not been the case hitherto. Of course, as Major Barker has remarked, in most places in England there is a great difficulty in getting ground, and he suggested that the barracks should be sold and camps formed. I do not think this would be possible, you cannot do away with barracks in their present places, but I think that if the War Office would allow a little money to be spent, arrangements might be come to with the farmers, who would, after harvest, for a small payment, allow men occasionally to work over their ground, and a great deal of useful instruction might be gained in that way. Major Barker deprecates too much barrack-yard drill. We may have too much, but we may have a great deal too little, and he will find if he attempts to take men out and to place outposts, or work in extended order over rough ground, before they have been carefully drilled on a parade ground, they will not do their work efficiently. I know many think that you can take your men out to some extended position and place your outposts at once; if you do, you will find the young soldier will scarcely know the meaning of outpost duty, and will when on sentry very likely face the wrong way. You must work them beforehand in the barrack-yard. With regard to inspections, I think nothing can be more utterly absurd than the inspections of the present day. They do not test the efficiency of the battalion in the least. Many a battalion that has the best report from the General at an inspection may be one of the most inefficient in the Army, because they can do nothing but march past, and are not practised in the more important parts of their duty. With regard to striking out a number of the manœuvres from the Field Exercise Book, as Major Barker proposed, I do not think I quite agree with him. I am not going *seriatim* through all those that he has mentioned, but I think most of them should be retained. I think it is necessary that a battalion should be able to be manœuvred in any position in which it may be placed. One thing is a little lost sight of, and that is that the English Army cannot be trained quite in the same way that a Continental army is trained, and for this reason, that a Continental army is not likely to fight against any but an European nation, and therefore they must fight in extended order; but that is not the case with the English Army, we have a great deal of savage warfare, and anybody who thought of attacking Arabs or Zulus in attack formation would commit a great folly, and would court disaster; therefore we must go on with steady drill, and shoulder to shoulder line, because in fact we have more fighting with savages than we are likely to have with European nations. I think the tendency of the lectures delivered at this Institution has been sometimes rather to lead people to believe that we need not have steady drill, and that we may rush on anyhow. That is quite a mistake, as Lord Chelmsford has said. There is nothing that requires more careful drill than the attack formation, in which it is of the utmost importance that the men should keep their direction and distances; if they go straggling all over the place, what a mess you will get into if you are attacking with a large body of men. Of course, with a battalion working by itself, if you do get half as much

extension again as you ought to have it makes no difference ; but if you are a part of a Division or Corps d'Armée, and a battalion takes up 100 paces more than it ought to do, what is to become of those next you ? You will get into the greatest possible confusion. With regard to the bugle sounds, I have suffered like Major Barker. I do not know them all : I know a certain number, quite enough. There is a little difficulty though about signals. I am a great advocate for signals, and I have worked them a great deal, and have found them most useful on outpost duty ; but a Captain cannot signal to his fighting line, because they have their backs turned and won't see his signals, and now that we extend half a company in front and half a company in support, I do not think there will be any difficulty in the Captain giving his commands to all his men if he will put himself in the proper place, not placing himself close in the fighting line, which ought to be under the command of a subaltern and the section leaders, where he can see nothing, but by taking up a central position between his fighting line and support, where he can exercise control over the whole of his company, I think he would then have no difficulty in giving his orders. Therefore I think we may do without bugle sounds, and I do not think the signals are of very much use in the extended order.

Colonel MONCRIEFF (Scots Guards) : Sir Lumley Graham and gentlemen, I do not wish to trespass upon your time by going through this lecture *seriatim*, as I think that after what Lord Chelmsford and Colonel Davies have said it has been very well criticized. The only thing I wish to say is, what perhaps some of you may not know, that at present the Commanding Engineer in London is preparing some screens which are an adaptation of those used in Belgium for ranges, and they will soon be put up at Wormwood Scrubs, and it is hoped prevent the bullets going into the convict prison. If these screens turn out a success it appears to me we shall be able to have ranges almost anywhere. A few yards in front of the firing point there is a screen with a longitudinal aperture of about 10 inches. Through that space the man firing can see the top and bottom of the target, and by that means quite sufficiently to miss the target as easily as he ever did before ; still if he touches the top of the lower edge of the aperture the bullet is deflected upwards on to an iron plate and falls harmlessly to the ground ; if it hits the top edge of the aperture it is deflected downwards, and so cannot get away to the front or side. I think with that improvement the musketry instruction difficulty will be practically overcome. With regard to what Colonel Davies said as to working your companies, I had some experience in that in winter time some years ago. I found that the Rev. E. W. Warre, now Head-Master at Eton, was able to take his Eton boys over almost any of the farms about the country, and with his help I took my battalion to ground we had never thought of being permitted to use. We occupied miles of undulating grass land and did no harm to it at all. The 1st Life Guards provided the cavalry for both sides, and the Eton boys fought against my battalion. It appears to me that this might be done anywhere : it only wants perhaps a friendly visit on the part of the Commanding Officer to the farmer, and as far as I could ascertain in those parts the farmers were only too glad to welcome the soldiers at that time of the year, when they were under proper control. I am quite certain that public-spirited farmers at the proper time of the year will cheerfully co-operate with Commanding Officers, and will thus materially assist in the training of our soldiers.

Colonel G. P. EVELYN : Perhaps like my old brother Officer, Lord Chelmsford, I may be considered one of the old school when I regret that the tendency at present is to do away almost entirely with what I consider very important, steady drill, by rushing our recruits and young soldiers into extended formations and also by carrying on our musketry and target practice in the same harum-scarum way. We let our men fire at enormous ranges before they are able to hit at short ones. We seem also to forget two very important facts : that the object of the soldier in action is not to fire away an enormous number of rounds, but to place one round successfully. If every man who went into action could only place one shot effectively he would do more than his share of injury to the enemy ; but we load our men with cartridges ; we let them fire at enormous ranges, though we know their fire is perfectly ineffective ; and, strange as it may be, there can be little doubt I fear that on service our infantry fire is less effective now, less destructive to an advancing

enemy, than it used to be in the days of muzzle-loaders. I think that is very much due to the action of the smoke caused by rapid firing, and also to a fact which is usually overlooked, namely, that rifles are masked if men are not in good order. If your line has intervals in some places and is crowded many deep in others, a great many of the rifles become useless because the men mask each other's fire. That shows the enormous importance of steady drill. I look upon it that if men are taught to use their arms properly, to understand the use of their sights, to bring the rifles well to the shoulder, and to keep their proper place and space in the ranks, they shoot quite effectively enough for soldiers of the line, and probably better than if they had been all marksmen who could win prizes at shooting competitions but had not done plenty of drill. Firing at long ranges and quick firing are the two things that destroy the efficiency of our infantry. Those are the two points we have chiefly to consider. I was glad to hear the last speaker express the opinion that our authorized formation of attack, of which we have heard so much of late years, is utterly useless before the charge of an uncivilized force; but I venture to remark that it has taken us some time to find that out; we did not know it at Isandlana; we did not know it at Maiwand; we did not know it at Ahmed Khel. In the latter action I think we put ourselves in the order of attack according to the book with our firing line, our supports and reserves. We were going to attack the enemy in his entrenchment position, but the enemy not understanding our game took into his head to attack first. Down they came on us; we had to reinforce our firing line with the supports and then with the reserves; our companies, battalions, and brigades were intermixed, and instead of having a good line to oppose them we had a line ten deep in some places, and with large intervals in other places, and utterly unable to manœuvre. The attack was thrown back with extreme difficulty, and it was very near ending in a catastrophe. That was entirely due to our applying to savage warfare principles which may probably be sometimes applicable to regular warfare, but which are quite unsuited to repelling hordes of Afghans, Zulus, or other savages. That having been discovered I hope we shall not make the mistake in future. I must say that we ought to fire at short ranges and not at long ranges, and I believe the great bulk of our practice should be at small targets at short ranges. If we kept to that we should no longer have the great difficulty we have at present in finding ranges in this thickly populated country. The system of screens, though well known in Italy, Switzerland, and all over Europe, has never yet been adopted by us, and foreigners look with surprise and wonder, as I know by what they have said to me, at the cool way in which we fire at Wimbledon. They see a thousand ladies and gentlemen within a few yards of the line of bullets, and they say that alone sufficiently shows them the extraordinary steadiness and nerve that must be possessed by our Volunteers. They would be afraid to trust foreigners or their own people to shoot under such circumstances—which indeed does look extremely dangerous. I believe any man who can put nine bullets out of ten into a target the size of the crown of a man's hat at 120 yards shoots quite well enough for any purpose whatever, and all the long-range shooting that we hear of occasionally as being useful, as for instance the case which occurred in the Franco-German War, was none of it aimed fire. I believe that in the few instances that long-range firing is useful on service it will be found to be an aimless fire, merely to deluge the ground with bullets without any special aim. Short ranges and small targets should be our plan, and steady drill, and by all means never mix up companies and battalions in the attack. Troops should be kept in close formation as long as they are not within the enemy's sight. When extended they suffer much more from random, long-range fire.

Lieut.-Colonel Rt. Hon. J. H. A. MACDONALD: Sir Lumley Graham and gentlemen, it would not be possible for me to use language of exaggeration in expressing my feeling of great satisfaction at hearing an Army Officer deliver in this theatre such a lecture as we have heard to-day. And I feel that in saying that I am expressing not only the opinion of myself as a Volunteer, but the opinion of the great body of Volunteers who, though many of them may be very bad judges of such subjects, have at least the advantage of being able to look at such matters as amateurs, and therefore free from the fetters of preconceived notions. It fills us with delight to find that within the British Army itself is rising up a call, a strong call, and a

well-expressed call, for things for which the critic has for the last 20 years been persistently endeavouring to obtain a hearing. I think you, Sir, have long held that many things in our Drill Book ought to be simplified, and, above all, there is one thing you have pleaded for, which I am sure if it is pleaded for in the right sense must ultimately obtain success, viz., that men when they are moved should not move by mechanical touch without the aid of the eye, but should invariably move with an interval, and exercise their judgment and their intelligence, and acquire the habit of moving correctly, though moving with an interval. And I must say that I think there is a use of words in reference to drill as between what is called "loose drill" and "steady drill" which is entirely erroneous and misleading. The suggestion that if you begin to drill and drill always with an interval, your drill must therefore for that reason be loose drill is I consider a great mistake.¹ Now let us see what necessarily must happen in every war in which a civilized country may now be engaged. It necessarily happens that if two civilized nations are opposed to one another in war with the weapons we now have, that the one which has to approach the other must approach the other for at least a mile and a half in an order with intervals between the men. That is the condition of combat up to the moment when you are ready to charge at full speed and to take the position. Every man who has to cross that mile and a half must do so with only the eye as a guide, with the assistance of course of the supernumerary rank to prevent general drift. Now the means by which we shall prevent confusion caused by drift and the line getting too thin at one place and too thick at another, and thus prevent one regiment overlapping another and taking up its ground—an evil referred to by Colonel Evelyn—is by training men persistently and constantly at marching and doubling with an interval between the files, and teaching them to observe that interval correctly. I maintain that is what you require to do in your barrack-yard by the most exact and steady drill, but if you put the men together with their elbows rubbing one another, and teach them to march in that way, you are not only giving them no aid to learn the mode in which they must pass the fire zone, but you are on the contrary introducing a principle which is absolutely inconsistent with what they have to do on service. The principle of marching with touch is for the express purpose of preventing the men exercising any intelligence as regards interval—preventing the men using the eye at all—every man being in fault in the ranks when he is out of touch. His business is to find his man if he loses him by feeling for him. We all know that that is not what he does when on service. We know if you were to teach men no steady drill but that of marching by touch, that you would not be teaching them the mode of movement used in war. The moment you get to Aldershot, or the moment men are put into a ship to go out to war, from that moment to the day when they come home, they never do march by touch. I have seen battalion after battalion pass me at Aldershot marching in column, and the men do not march by touch; they march as men of sense always would by keeping reasonably near, but every man having freedom to clear himself of the obstructions before him, and having freedom to use his lungs, which he cannot possibly have with his arms close by his side. The natural action of swinging the arm in walking is not an action of a mechanical nature for the purpose of helping the body forward—we all know that it cannot do that; the action of the arms is perfectly involuntary, and is the means Nature provides for keeping up the circulation in the arms. If a man holds his hand hanging straight down, the whole of the veins of that hand immediately swell up and the hand becomes uncomfortable. If he swings his hand two or three times without raising it at all the blood resumes its proper circulation and relief and comfort are the result. In the old days it was perhaps advisable to sacrifice some of the advantages of following the natural course for the purpose of obtaining what you then wished to obtain; you wished to present the appearance to your enemy of a wall that nothing could throw down, and which also moved like a wall, and as it advanced was so solid that it would push down—morally and even physically push

¹ "Loose" in the sense of "irregular" or "inexact," is to be shunned as ruinous. The word should never be used as it is ambiguous. "Open" would be much better.—J. H. A. M.

down—that which was in front of it. You cannot produce that result now ; your wall must be carried forward in bits and put together at the last moment. It is impossible for you to cross the fire-swept zone as a wall, and therefore the sooner you abandon the idea of working as a permanent wall at any time the better. Now let us see how we begin with a recruit when we take him into the barrack-yard. The first time we move him about we always put him in order with intervals, and we practise him in marching about the yard with the intervals, making him keep his proper distance from the man on his right—if it is by the right, and from the man on his left, if it is by the left. We do that, I suppose, in order better to observe his movements, but at all events we begin operations by making him move with an interval from the man next him, and we do succeed in obtaining accurate movement with interval. Under the conditions of modern warfare for what purpose do we then change our mode and teach him to move touching the elbow of another man? I think it is inconceivable that men can be in any circumstances *where they are to move* in which there is the least reason why they should touch one another at all. The thing you want now, whether your soldier is ill or well trained, is for him to be able to cover with considerable speed a distance of a mile and a half, and you must leave every man's body so free that his action in covering that distance shall be a natural and not an artificial one. Now having got your recruit and begun to drill him in an order with an interval, you still put him afterwards into rank with touch. We have made some progress in giving a man liberty to move naturally. Forty or fifty years ago he was only allowed 20 inches in the ranks, he was afterwards allowed 22 inches, and now we allow him 24 inches. But what do we do? We drill him about in those 24 inches for half an hour or an hour, and then we suddenly tell him we are going to do the business of attack! and what do we tell him then? That he is to have touch no longer, even while he is standing in the ranks, but is to occupy 30 inches of front. Therefore the moment you suggest to the soldier that he is going in for business you at once practically confess to him that what you have told him about rubbing elbows and keeping his eyes fixed to the front has nothing to do with the business in which he is to be really engaged. Again, I beg to be understood that in speaking against touch I say nothing against steady drill—quite the contrary; but I say that, as in former days, the spirit of the combat was consistent with and made touch a necessity; the spirit of the combat has now absolutely departed from that arrangement—of the men standing by their elbows touching—and has entirely gone over to that part of the soldier's work which is done without touch; therefore I say as the spirit of the combat is out of that touch style altogether, let us get rid of it altogether, and let all the training we put our men to be a training in which our constant aim shall be steady drill, but a steady drill which shall train them thoroughly to that they have to do in modern warfare, namely, to move with an interval between them. A great part of our drill has been carried on not realizing that this change has taken place, and therefore our two classes of drill come to be absolutely separate things. That should not be so. I rather think the sound principle of drill would be to a constant transition in the course of the same drill from strict drill—that is, work done with the most absolute regularity that can be got—dressing, and everything of the kind—to the action drill, in which you do not study dressing, but endeavour to work according to the circumstances of the ground, and to work with greater freedom under the control and direction as distinct from the word of command of the Officers. It is the wearisomeness of the long hour, perpetually doing things in a stiff formation, which is unsuitable to modern warfare; that is the objection to our general parade drill; whereas if the parade and the practical were, so to speak, interspersed one with the other, using words of caution, indicate the transition from one to the other—giving the word “Action Drill,” and then for a quarter of an hour going on without any attention to dressing, points, &c., but rather pointing out how inaccuracies have arisen, and the way in which they are to be avoided in the future; then giving the caution—“Parade Drill,” and moving your men about for another quarter of an hour, with dressing, points, and every minuteness and strictness of form you please—would not this be an enormous improvement? But the things in which extra smartness should be exacted should be restricted. I happen at present to be living where

I have a view of one of our barrack-yards. Now I think that we have gone too far in the matter of looking for smartness in things to which it should not apply. I saw this morning a whole battalion engaged a whole half hour in listening to the words—"Stand at ease," and "As you were." I do not mind hearing the words "Stand at ease." I think if they were used oftener during drill, and really meant what they express, it would be an improvement. To a lady who had never seen military parade, the words "Stand at ease" would at once suggest that the people addressed were to be allowed a little freedom and relaxation, but instead of that, so determined were our forefathers that everything that was done by a soldier should be as stiff and wooden as possible, that the "Stand at ease" has come to be a part of our exercise in which we do not cause the men to stand at ease, on the contrary, put them in a fixed position, and have had to invent another word, "Stand easy," in order to give the relaxation which the words stand at ease would seem to imply.¹

The CHAIRMAN: Will you allow me to remind you of the rule of this Institution? I am sorry to say you have already considerably exceeded your time. What you have been telling us is very interesting, but there are a good many other gentlemen who wish to speak.

Colonel the Hon. PAUL METHUEN, C.B. (Scots Guards): I speak, Sir, as one neither of the old school nor of the new, but if there is one branch of our forces which will suffer by Officers in the regular Army speaking out too openly and freely about what they consider now to be necessary, namely, "loose drill," to the detriment to a great extent of steady drill, I think that branch of our forces will be the Volunteers. I am not one of those who are always anxious to quote the armies that we should look upon as a pattern, and deservedly, but at any rate I know Sir Lumley Graham will agree with me, that if we are to look at any army for what is good in matters of drill, it is the German Army; and believe me, good as they may be at their loose drill, there is no army which pays so much attention to steady drill. If, as a fencer, I think of the trouble that I take with my fencing, and think how very few of the complicated movements I learn in my lessons I am likely to put into practice, still I feel certain that the more trouble I take with my lesson, the more trouble I take to make myself a thoroughly steady close fencer, the better it will be for me when I fence. So it is with drill. I feel quite convinced that when you think of the number of hours that a battalion is drilled in the German Army, and of the comparatively few hours we drill in our English Army, seeing that we have our men at least three years, and they have their men at most three years—surely we are not expecting our men to learn too much, when we say that they must be able to do their steady drill, and also be able to do their loose drill. But our present difficulty is, and it always has been so, is this—our recruits do not come together at the same time of the year. In the German Army you have a regular routine. They join in the middle of October. You hand the men over to your sergeant, your sergeant to the Lieutenant, the Lieutenant to the Captain, the Captain to the Colonel of the battalion, the Colonel of the battalion to the Colonel of the regiment; then the Brigadier takes them, then the General of the Division. Then comes loose drill. Now observe, there has not been one atom of loose drill mixed up with the steady drill. The men from October to May have received instruction in steady drill. In May the Captain of the company takes his men in hand, and here is what I urge very strongly, namely, that if you choose to have your field training for a battalion all together, for mercy's sake be careful the

¹ Had I not been most properly stopped for trespassing the rule as to time, what I wished to say would have prevented my giving a false impression, which my friend Colonel Trotter said good-naturedly he was sure I did not mean to give. I had no intention of suggesting that the Guards took a long time to learn the "Stand at ease," but only of indicating that the original intention of these words had been lost in the effort to make *everything* like clockwork, and that the Guards' drill-sergeants in setting up drill, had to struggle as hard at "one," "two" at the "stand at ease," as if it had been an important order.—J. H. A. M.

Commanding Officer and the Adjutant do not take away the company from the Captain. There is the secret. From the beginning of May until the beginning of August, you can give your Captain his company, and you say as Commanding Officer, "You are responsible that these men learn their loose drill, that they learn outpost duty, that they know all the varied work that will take place in the manœuvres, and if I find any company of any battalion not thoroughly well up in this work during manœuvre time, I shall take remarkably good care that you, the Captain of the company, suffer for it." If you want all your units of battalions to be thoroughly good and efficient, that is the system and no other. In Germany after the manœuvre month of August and September, the soldiers of the third year return to their homes. There you have a thoroughly clear system, you do not have that at Aldershot. Company training is knocked on the head for a march past; by all means have your march past at the proper time, but do not let us in the middle of the training of a Division, brigade, company, or battalion, all of a sudden have to knock the whole system on the head, in order to have two or three days' practice for marching past, preparatory to some review, inspection, or large field-day. I thoroughly agree with Lord Chelmsford that every good battalion ought to march past. I think that any battalion ought to be able to do the steady drill and march past, and also ought to be able to do loose drill without the slightest trouble. I think one should not interfere with the other, but I do most cordially hope that Volunteers, who have hard enough work, goodness knows, to turn out their men as well as they do, will think most earnestly before ever they consider that loose drill is to take the place of steady drill. I think if we can get our Volunteers and Militia to do their steady drill well, we shall have done uncommonly well.

The CHAIRMAN: I should like to hear the opinions of any working regimental Officer present.

Major FAWKES, Royal Irish Fusiliers: I have only one suggestion to make, and that is that in garrison towns like Portsmouth, where there are companies of two or three different regiments struck off duty for instruction at the same time, they might combine for manœuvring, especially in the latter part of the course. I tried this myself at Portsmouth one year and it answered very well, and gave an interest to the men which would otherwise have been wanting. Failing this, which perhaps could not always be carried out, and in places where there is only one kept, two companies ought to be exercised together *at least*. Major Barker truly says, it is often necessary to manœuvre one half-company against the other, which is useless for instruction. I throw this out merely as a suggestion that occurs to me.

Captain H. C. BOYES (London Rifle Brigade): May I be permitted as a Volunteer Officer to make just one remark with reference to what Colonel Paul Methuen has just said, when he asked us to confine our attention to steady drill? In saying that it appears to me that he has by no means contradicted what my friend Colonel Macdonald has been urging, for I distinctly understood Colonel Macdonald to say that there was no difficulty whatever about having steady drill, but steady drill without touch. It appears to me that that is the whole matter at issue—can we or can we not do loose order drill steadily? If Colonel Methuen, or any other practical soldier, says that we cannot, then we must take into consideration the necessity of going on with drill with touch, but speaking with considerable experience, extending over 23 years as a Volunteer, I maintain that it is possible, especially with such men as we have in the ranks of the Volunteers, to have a thoroughly steady drill without touch. I will yield to no man in my belief in the necessity for steady drill; I am also certain it is necessary that drill should be drilled into the men; men in the ranks must be made to a great extent to drill like machines, they will not lose the necessary intelligence for field manœuvres, but will be all the better for it. But what I want to know is this—why is it impossible to drill them like machines in loose formation, instead of in close formation?

Colonel TROTTER, Grenadier Guards: My friend Colonel Macdonald said, I believe, that it took the Guards half an hour to stand easy. I know he did not mean it. At the same time I must remark that I believe the Guards are known to practise steady drill more than any regiment in the Service. I am told practice is better than theory. Now at the Battle of Abu Klea the Guards Camel Corps were certainly in close order, when they stood extremely steady; perhaps if they had not stood quite so

steady the Camel Corps would not have returned to tell the tale. I certainly advocate steady drill as well as open order drill, but I think we must begin with steady drill first, and practise the open order drill afterwards.

MR. GRAHAM WILMOT-BROOKE, 2nd V.B. The Queen's Own (Royal West Kent) Regiment: With regard to this steady drill with intervals, we had practical experiments of that kind in our battalion in two companies. It was found that the open, or loose drill, as it was generally practised in Volunteer battalions, certainly did unsteady the men, and the men who were very steady in close order were very unsteady the moment loose order began. We therefore tried drilling in a steady manner with accurately kept intervals, and the result was that the drill in extended order in attack formation really became as steady as the ordinary close order drill by touch. The men were drilled in a large drill hall, with intervals very accurately kept, and they soon marched as carefully with intervals, and by eye, as they had before done by touch. The difference in the fire discipline, and everything connected with attack formation, and moving in extended order, was very marked indeed. I am sure there must be a great deal in this system of drill capable of development.

Captain TULLY, late 28th Middlesex Rifle Volunteers: It is with a little diffidence that I rise to say anything, because the subject brought forward in the lecture has been almost fully covered by the various speakers, and I take it for granted that unless something fresh may be considered, someone more experienced than myself in these subjects had better address the meeting. I wish, however, to mention one point, as to which perhaps I have a special knowledge, and also to point out something that struck me in the course of the discussion, and with regard to shooting. Colonel Evelyn said he considered steady drill to be the first necessity of shooting. We shall later on in the session have a lecture here on the new military arm, and that arm will perhaps be fully discussed. I should otherwise, perhaps, have gone into more details, giving my views about the Martini-Henry, and spoken of the various points connected with shooting, because I think they would bear very materially on the question at issue. My deliberate opinion is that it is not possible to teach the soldier to shoot accurately with any amount of drill with the present Martini-Henry rifle. I remember very well my first experiment with a herd of antelopes. These deer were the first living objects I had ever shot at. I took an accurate position, and sighted the rifle very carefully; I missed every shot for the first ten shots, although the deer ran straight at me, and passed by me 70 yards off. That is my personal experience, since which I have been very dubious about the advantage of theoretical musketry instruction. What we want is a rifle which can be readily raised to the shoulder. If a man is to be practised continually at short ranges he must have an unlimited supply of ammunition, and he must be taught not to bring the whole of his muzzle and the whole of the foresight into the line of sight, and to do that it is absolutely necessary that the stock should be brought rapidly to the shoulder. Every Officer who has shot big game or birds will know that he has his gun fitted to his shoulder, just as his clothes are fitted to it; the stock of the rifle must be made so that it fits him, then he raises his gun up and hits the bird. But let any Officer in the Army take the Henry-Martini rifle, with a hair-trigger if he likes, and see how long it will take him to "draw a bead" on any bird or animal of any kind. I believe that, take it altogether, the lecturer and the speakers are very much in accord, and also that Colonel Macdonald and Colonel Methuen are very much in accord. I apprehend Colonel Macdonald to mean that it takes more continuous practice to make a man drill well in loose order than in close order, and that a man must be a far better drill to drill in loose order than to keep his "touch." I apprehend the lecturer to be desirous of knocking out a number of useless formations, which will give more time to practise steady drill, and more time to practise those items of loose drill which are absolutely essential to the modern order of battle. It appears to me, therefore, that there is not much issue joined, either between the various speakers or the lecturer, and I confess that with my friend Colonel Macdonald, and Captain Boyes, I have an extreme belief in the value of loose drill as interpreted by those two Officers, and I believe it will make the soldier much better at steady drill if you put him back to it, than if you practise him at steady drill and then only for a change rush him into a loose formation.

The CHAIRMAN : I have been very much interested by this lecture. The chief point of it, and a very valuable point I think, is that Major Barker seeks (what we all wish, no doubt) to make the Army a really efficient body for war purposes. No doubt that was at one time rather left out of sight in this country. During the long European peace the Army at home had become rather a parade army, though it had during that very period a lot of fighting to do in out-of-the-way places ; but things are different now, though some relics of these days of torpor still remain. Major Barker's suggestions, or the greater part of them, are very valuable towards making the Army even still more of a fighting army than it is. He spoke of the small number of men available for drill in battalions on the reduced establishment, that is to say, the great majority of the battalions at home. The different classes of remedies that he has proposed all seem to me to be good in their way. First of all, the extension of service for men in India ; that will tend indirectly to produce the result he wishes, namely, to give us more men for training at home, and that I hope is a change that will be carried out. It is an idea that seems to be generally approved of. Then as to the reduction of guards and orderlies. Really I think there is a superstition about guards. It is thought to be necessary to have a guard here, there, and everywhere, and as the lecturer and others have said, in many cases flying sentries, or small patrols, would do the work much better, with less detriment to the men and with a great economy of labour. A very small number of men would then be kept away from drill by duties of this description. Then as to orderlies ; the amount of orderlies that there used to be, and I believe still are taken from corps in garrison towns and camps, is something distressing to Commanding Officers who are always called upon to send their best men to act in this capacity, and these are temporarily lost to them. This question was gone into some years ago at Berlin. They wanted as many men as possible in the German Army for training, and they established a system of communication by telephones or telegraph between the different barracks and military departments, so that almost all the work of messengers was done in that way, at a great economy of labour.

Colonel METHUEN : You do not see one orderly in the War Office there.

The CHAIRMAN : It is done by a system of electric communication.

Colonel METHUEN : There are one or two old soldiers there.

The CHAIRMAN : The German authorities understand the necessity of economizing labour as much as possible.

Colonel DAVIES : In the Southern District telephones are used now in all the barracks and forts.

The CHAIRMAN : I hope it has the effect of doing away with a number of orderlies.

Colonel DAVIES : We never send men out as orderlies.

The CHAIRMAN : I see them in London a good deal. You must have a certain number of orderlies in the Staff Offices and departments. I should think that this is an opening to use discharged soldiers for that purpose. A great number of unemployed reserve and discharged soldiers would be very glad to get any work of this sort, and I think you might find a good many men of that class who would be very useful for this purpose. All these things would tend to help Major Barker's object of getting as many men for drill and instruction as possible. With regard to company instruction, I think there is no doubt that it is the foundation of all solid military training, and that Captains should be allowed, as they are in the German Army (as Colonel Methuen pointed out) to have their companies to themselves, without interference for a certain time every year to work them up. Carried still further, Commanding Officers of battalions ought to have their battalions to themselves for a certain time afterwards to work them up, and they should not be constantly interfered with, as they are too often in this country, by General Officers' parades, which interrupt the regular order of regimental training. In the German Army the training of the different units from lowest to highest is carried out in a regular succession, and one of the great wants in our Army is this methodical system of training, carried out in a regular course without interruption. I have always been of opinion, as some of my hearers may know, that we might gain a great deal in every way by adopting the four-company system in our battalion

organizations, and there are a great many arguments to my mind in its favour, which I won't trouble you with now. This is not the time to give them. But there is one argument that applies specially to this question which I may mention, and that is, that by having the battalion divided into four companies instead of into eight, you give the Captain double the number of men to make use of; therefore, when a company is kept off duty for training the Captain will always be sure of having a fair number of men to work with. I think that is one of the many arguments in favour of a system adopted by every army on the Continent; but I am sorry to know that it is distasteful to the higher authorities of our Army, and I will say nothing more about it on this occasion. Within the last two or three years a great impulse has been given to company training, which had before been at a low ebb, many excellent orders on the subject having been issued, but it is difficult to carry out those orders in the great majority of the battalions at home on account of their weakness. If the companies were stronger—as I wish them to be, double their present strength—without increasing the establishment of the Army, it would give much greater facility for carrying out the very excellent orders referred to. I am persuaded that you cannot have a thoroughly efficient infantry regiment unless the companies have complete training by their own company Officers. With regard to the simplification of drill, most people admit that it is advisable. There is a great difference of opinion as to the amount of mere drill that is required; I am one of those who wish for less drill and more instruction. I quite believe that absolute steadiness is required; I would have steadiness not only in the mere drill but in every part of a soldier's training. I have sometimes remarked that when companies extend in skirmishing order it seems to be thought that all steadiness may cease. The men are allowed to play about and laugh. That ought not to be. Soldiers ought to be quite as steady when in extended order as when in close order, and I am persuaded that this is a very great point to insist upon. I am inclined very much to agree with Colonel Macdonald,—whom I was very sorry to interrupt, but it was only in consequence of the pressure of time—I was very much interested by his remarks, the more so because I have just said I am inclined to agree with them. I long ago thought that the system of drilling at intervals (in extended order, in fact) was an excellent one, and that if a soldier were thoroughly, not loosely, trained from the very first to work in extended order he would move much more steadily and efficiently before the enemy. There were other gentlemen who supported that view also, but I am aware that there is a very strong feeling against it. I am afraid I shall be thought a great revolutionist in the Army generally for advocating such a thing, and I am bound to say that the German Army, which we look upon as the first army of the day, in war is very strict indeed about these steady movements. When I was at Versailles in the middle of the siege, I saw the German troops off duty, those who were not in the trenches, actually drilling at what we call irreverently the “goose step,” and at what to my mind is very absurd, namely, their prancing parade march, just as if they had been in garrison at home. The snow was on the ground, and I saw them all out by squads at the stiff drill. The next day they would probably be in the trenches, either fighting or prepared to fight. So that it is only fair to bear in mind that German soldiers, who are certainly the most successful of the day, lay a very great stress upon this stiff drill, and it is stiff drill with a vengeance in the preparatory stage. Still, for all this, I should like to see the system advocated by Colonel Macdonald, and I may add by myself years ago, tried fairly. I believe myself that it would be successful. I will not go into any of the points the lecturer spoke about as to the sections in the “Field Exercise” that he would recommend to be abolished or else modified. I think that is a question in which the able Officer now Adjutant-General of the Army quite sympathizes with Major Barker, as I have heard him in this theatre several times express very strongly his opinion that there was a great deal of unpractical matter in the “Field Exercise” book, even since its frequent amendments, which ought to be taken out of it, and I think we may be quite sure that that subject will be looked into carefully and speedily. It will, I hope, be submitted to a Committee of experienced Officers, amongst whom I think there ought to be a large infusion of regimental Officers. With regard to musketry instruction, which is also now under consideration, I always was of opinion when I

was a regimental Officer that the musketry instructor was a person who ought to be done away with, and I welcomed the change when he was done away with, because I always thought he was a thorn in the side of a good Captain, and that he was a dangerous encouragement to a less good Captain to neglect his work, or slur over it. It is very difficult to prevent an official of that sort from interfering with the instruction of companies. But it is possible that there may be room for a musketry instructor in a battalion for the purpose of doing all that sort of work alluded to by the lecturer which is beyond the province of the company Officer; but if the musketry instructor be re-established, all I hope is that he will be strictly forbidden to interfere in any way with the company musketry instruction, or even to be present at it. The most important branch of musketry instruction has been carried out very little in our Army until quite of late years, and that is what we call field firing, what the Germans call "war firing." That is the most important practice of all, and it is only of late years that we have taken to it at all, and even now it is not carried out very completely. It is a most important practice, because it not only teaches men to fire under the conditions most nearly approaching to those of active service, but it also teaches that most important thing of all, fire discipline, and teaches Officers and non-commissioned officers in the noise and excitement of action to handle men, and how and when to employ all the different sorts of firing that should be resorted to under various circumstances, therefore it is practically most important both to men and Officers, and I think the want of that training is the chief reason of the comparative inefficiency of our firing since our troops have been armed with the breech-loader. There is one great difficulty in carrying out a system of field firing in this country, and that is the want of proper ranges. I was happy to hear from Colonel Moncrieff that with regard to the ranges for ordinary target practice that difficulty at least is in a way to be overcome, but that does not do away with the difficulty for field firing. You want a very extensive piece of ground for that purpose, and there are very few places in this country where we have ranges fit for field firing. It would be an advantage if the Government would buy some pieces of ground on the moors in the north of England and in the midland counties, so as to give us one or more other Aldershots, not for troops to be moved out of the towns to be constantly quartered there, as the lecturer suggests, but to be used at certain seasons for this very purpose of field firing, and for other training. I know there is very great difficulty, that a great deal of money must be spent to give us proper ranges, but I do not think that it is money that will be refused by the nation if we can bring it home to our fellow citizens that it is bad and dangerous economy in these days to deny our infantry of the standing Army, Militia, and Volunteer force the means of making themselves thoroughly acquainted with the use of their weapons. The concluding remarks of the lecturer I thought very good, they quite chime in with what I feel myself with regard to General Officers' inspections, and Lord Chelmsford, who no doubt has inspected a good many regiments, quite agreed with the lecturer that the system of inspection as laid down by authority was not what it should be. As long as you have a system of inspection which goes very little beyond the merely ornamental part of military training you won't have the more important practical part thoroughly attended to. The lecturer alluded to some remarks made by Prince Hohenlohe, a very distinguished Officer in the German Army, on that very subject. He published a book upon infantry, of which I translated certain portions, which appeared in our Journal. He well sums up this question of inspections by saying, "A corps will certainly be trained so as to fit it for the sort of inspection which it will have to undergo." This is certainly the case, and if you want an army fit for war, make your inspections so as to go carefully into all that is important in warfare; if you want an army for show, go in merely for marching past and such like. I think that the British nation will prefer the former sort of army, and I have no doubt that with the material which we have in men and Officers we can obtain an army second to none in warlike efficiency if we go the right way to work. In the discussion there was a good deal said about the comparative merits of loose and steady drill. I think those terms are misapplied, "loose" and "steady." I do not think there ought to be such a thing as "loose" drill at all, all drill ought to be steady. But I think the lecturer was misunderstood by some of the speakers. I did not understand him for a

moment to mean that steady drill was to be neglected, he spoke of that as the means to the end. Steady drill is the means to arrive at the end which is warlike efficiency, but you may sacrifice the end to the means, and that is what we have done, in fact, a great deal in bygone times, and that is what the lecturer wishes to avoid, but he will speak for himself. I will not occupy your time further, but will ask the lecturer to reply to the remarks that have been made by the various speakers.

Major BARKER: I was very glad to hear the Chairman, and also Captain Tully, recognize that I did not belong to the school of those who wanted to have no drill at all. I think if anyone takes the trouble to read my paper carefully, he will see that I do not advocate less drill, but more drill. I am certainly an advocate of more drill than is actually carried on in the British Army at present, and as a means to that end I want to get all the men I can, and then to drill them as often as I can. Lord Chelmsford in his remarks said that we used to have more steady drill in line, and that we generally beat the French in that formation. That was all well and good as long as the line was the fighting formation. Of course, the more we had of advance in line and shoulder to shoulder the better, but now we do not fight in that formation; that is the question that goes to the very root of the matter. We fight in extended order, therefore I say, have as much extended order as possible. Of course you must have close drill to a certain extent, but have a great deal more drill in extended order than we have now. Colonel Davies says we must remember we have a great deal of savage fighting to do. So we have; but then again I wish to remark that it is not upon fighting savages that our honour and existence as a great nation will ever depend. Our honour and existence as a great nation may depend some day on the way in which we fight, and that fighting will not be in close order. I must say my sympathies are with Colonel Macdonald, but it required a certain amount of moral courage for an Officer in my position to come forward with a lot of revolutionary proposals, and I must say I was afraid to touch on that question. I did not like putting my views in opposition to those of a large number of very experienced Officers. Then again, it is an excellent thing for a Captain to have his men to himself. I wish he could have them a great deal more to himself; but what is the good of fifteen files to a Captain, what can he do? He can only do very elementary things. How can you do outposts with pickets, and sentries, and supports, and reserves, and all the rest of it, with fifteen files? How can you manœuvre seven and a half files against the other seven and a half? It cannot be done; the whole thing is impossible. And lastly, as regards the musketry instruction. I do not want to see the musketry instructor with any one's company. I would not allow him within half a mile of a company, but I do want to see a musketry instructor looking after recruits, and ranges, and all that sort of thing. It is no doubt good for young Officers to make them put through squads of recruits; it is good for the Officers, but it is not good for the recruits. I was at Hythe two years ago, and I am sorry to say I have forgotten a good deal of what I learnt there already. It is impossible to do your work thoroughly without doing it constantly. A man just told off to take a squad of recruits and put them through musketry forgets a lot of the little things he learnt at Hythe: he is more or less inexperienced, and cannot do it so well as a man who is always doing it. It is just the same as the question of the corporal instructor of recruits. A corporal instructor can do it better than an Officer, because he is always doing it. In the same way a musketry instructor, or an Assistant Adjutant for musketry, can put recruits through musketry a great deal better than an Officer who is just told off for the duty. I am sure I am extremely flattered at the way in which my lecture has been received. I did not expect very much sympathy, I expected, on the other hand, a good deal of opposition, and it has, on the whole, been quite the contrary. I will conclude by thanking you for your kindness.

The CHAIRMAN: I am sure you will allow me to present, in your name, a vote of thanks to the lecturer for his very interesting and able lecture, and to the various gentlemen who have joined in the discussion.

Friday, February 19, 1886.

ADMIRAL THE RIGHT HON. SIR A. COOPER KEY, G.C.B., F.R.S.,
Vice-President, in the Chair.

NAVAL TACTICS.

By Rear-Admiral the Hon. EDMUND R. FREMANTLE, C.B., C.M.G.

THE subject of my lecture this afternoon, although it has a short name, which I have not attempted to expand as I was desirous of having a free hand in dealing with it, is like the grain of mustard seed of Scripture, embracing in its comprehensive nature something at least of all those subjects of interest to the Navy which we are accustomed to hear discussed in this theatre. It is impossible to touch it without trenching on questions on which opinions will naturally differ, and I feel guilty of some temerity in attempting the task, daily becoming more difficult, of differentiating the values of the various arms and scientific appliances in use in naval warfare. It is however one which has always had a great fascination for me, both as a naval Officer and as a student of naval history.

Every naval Officer may hope or at least dream of crowning his professional career by commanding a British Fleet in action, and how that action should be conducted, when the time arrives or may arrive that the honour and perhaps the existence of his country is entrusted to his hands, is a subject of unfailing interest and study. The difficulties of the question to which I have alluded are no doubt great, but I cannot admit that they are insuperable, or that we can put off their consideration to a certainly not more propitious time, when the "dogs of war" have been let slip, and some action must perforce be taken.

I am at a loss to know whether to express my regret or my satisfaction at the meagre bill of fare which is at our disposal to enable us to draw from modern instances some lessons as to the value of the tools which we shall have to use. But while we may regret from the tactician's point of view that we have no recent examples of naval actions to guide us, let us not forget that glorious naval history of the past which is pregnant with lessons to those who read it aright as to those main principles underlying all warfare, which enabled our Nelsons and Rodneys to lead British Fleets to victory.

I should think it unnecessary to allude to this, but that it has not been the custom to make a serious study of our naval actions, and I

have observed that Professor Laughton's eloquent advocacy and illustration of the principles of the naval tactics of the past have been scarcely sufficiently appreciated by our young Officers.

But I am content to leave this part of my subject to Mr. Laughton, merely adding that I agree with M. Gougeard, the French Minister of Marine under Gambetta, who says that¹ "Retrospective studies are sterile only for superficial minds, for those who neither know how to understand nor to look deeply into things."

Leaving then the temptation to trace the gradual changes of tactics which necessarily followed on the improvement and development of ships' arms and modes of propulsion, I will at once plunge into the question of modern naval armaments, but, before doing so, let me draw attention to the fact that though what I have just stated is a truism as regards the past, there are many who are at least very reluctant to accept it when practically applied to the present, and who find it hard to realize the stubborn fact that changes in tactics must follow on every important improvement in naval armaments.

Six years ago, in an essay for which I had the honour of receiving the Gold Medal of this Institution, I endeavoured to deal with this subject, and I trust that I shall not be considered egotistical in referring to it, as to me at least it affords a convenient starting point for recent changes. Then as now we had the gun, the ram, and the torpedo as weapons of offence, we had ironclads and a few torpedo-vessels, which were rather experimental craft than as yet adopted in the Navy.

The "Vesuvius" had indeed proved some years previously that the Whitehead could be made a formidable weapon under certain circumstances, the "Hecla" was in commission as a torpedo dépôt ship, the "Lightning" had recently proved the hitherto unsuspected capabilities for speed of small steel vessels, which promised to add such an enormous power to the torpedo attack, and our ships in the Mediterranean had been armed with the Whitehead torpedo.

On the other hand, the "Polyphemus" was still on the stocks, the outrigger torpedo was in more general use than the Whitehead, the pattern of the latter, with which our ships were in most cases armed, were the fat 16-in. specimens which had a speed of $12\frac{1}{2}$ knots for some 300 yards, and which had the incidental advantage of having so much buoyancy that though they frequently skimmed the surface of the water they were seldom lost, the Whitehead was discharged from ships by the obsolete impulse tube, and the dropping gear was the mode of discharge generally adopted by 2nd class torpedo-boats, even those carried by H.M.S. "Hecla."

It is true that some foreign nations, the Austrians, and especially the Russians, were in advance of us in torpedo science. The latter had developed the torpedo attack in their war against the Turks, and in preparation for war with this country. They had already in 1880 adopted the torpedo-gun, and had actually fired Whiteheads against the Turkish ships at Batoum, while their torpedo-boats, mostly 2nd

¹ "La Marine de Guerre," 1884.

class boats built in England, in 1879 numbered over 100, but even the Russians had not been able to score any success with this weapon, the two Turkish gunboats sunk by them in the Danube having fallen victims to the outrigger torpedo, as Admiral Hobart Pacha tells us,¹ "through keeping a bad look-out."

Such was the position of the torpedo six years ago. To ground-mines and the outrigger I do not refer, they had won their spurs in the American War, but I think I was justified in speaking of the Whitehead at that time as "still in its infancy."

This description of the Whitehead torpedo, whether accurate or not at the time referred to, is certainly inapplicable to the robust manhood it has now reached; true it is a complicated weapon which scores not a few failures, as those who have had practical experience of it in sea-going ships must admit, in spite of the somewhat rose-coloured returns of successful shots which are shown by official reports, but its power, its range, its method of discharge, its reliability, have all increased, and are still increasing. We must all admit the torpedo described by Commander Gallwey, in this Institution last March, with its speed of 24 knots for 600 yards, and its charge of 70 lbs. of guncotton, to be a most formidable weapon, and his assurance that the later patterns can be supplied fully adjusted and ready for use is not the least of the practical improvements recently made.

I have dwelt long on the Whitehead, as it is the automobile torpedo, and especially the Whitehead which threatens to revolutionize maritime warfare. The torpedo was born of chemical inventions in explosives, but this alone did not do much towards rendering it an effective naval weapon till mobility was supplied by machinery and the steel torpedo-boat.

The torpedo-boat proper needs no description here, nor have I space for technical details of the various classes, but the following table, which is I believe fairly correct, is interesting as showing that fleets of torpedo-boats are already in existence, and that in dealing with naval tactics they must be considered as potent factors which will have to be reckoned with.

Number of Torpedo-boats Built and Building up to January, 1886.

| | 1st Class. | 2nd Class. | 3rd Class. | Total. |
|--------------------|------------|------------|------------|--------|
| Great Britain..... | 61 | 19 | 50 | 130 |
| France | 57 | 41 | 9 | 107 |
| Germany | 59 | 5 | 3 | 67 |
| Russia | 26 | 92 | 20 | 138 |
| Italy | 47 | 5 | 18 | 70 |
| Turkey | 4 | — | 1 | 5 |
| Austria | 30 | 7 | 1 | 38 |

¹ "Blackwood's Magazine," June, 1885.

The classification of the torpedo-boats here adopted is as follows—

1st class.—Over 100 feet in length.

2nd class.—Over 70 feet, and under 100 feet.

3rd class.—Under 70 feet.

In Germany, money has been granted for 105 boats, to be eventually increased to 150. Four of the Russian boats are 152 feet long, and nine of the Italian boats are 148 feet.

I have taken the torpedo-boat proper and torpedo itself first, as it is the weapon in which there has been most change recently, but the “Polyphemus,” the “Scouts” building, the “Grasshopper” class of torpedo-catchers in our own Navy, and the “Bombe” class building in France are all developments of the torpedo and must be shortly dealt with.

The “Polyphemus” is an overgrown torpedo-ship or ram of special value under exceptional circumstances, but as I think too large and expensive a vessel to be often repeated, especially if the ram is to be made a secondary consideration. The new “Torpedo Ram,” or improved “Polyphemus,” of 3,220 tons, voted in this year’s Estimates, has not I believe been laid down hitherto, and does not appear in the January Navy List. We have seven torpedo-ships of the “Scout” class, 1,400 to 1,600 tons, built or building, which will no doubt prove useful vessels as cruisers and look-out ships, but they are 225 feet long, and draw 14 feet water, so that they are too large, too costly, and offer too good a mark for the Whitehead to be considered simply as torpedo-catchers.

Of these latter proper, or “Grasshopper” class of 450 tons, 200 feet long, and drawing 8 feet water, we have four building at present, though it is intended I believe to order more shortly. They are expected to go 19 knots under ordinary circumstances, and promise to be fair specimens of the “torpedo-catchers and destroyers” which Sir E. Reed and Sir N. Barnaby have agreed in advocating.

In the French Navy, they had already building eight *torpilleurs avisos* of the “Bombe” class, of 318 tons, and intended for 18 knots speed, when Commander Gallwey gave his lecture here last year, yet it was not till quite recently that our “Grasshoppers” were laid down, and as they are conspicuous by their absence in the Navy Estimates, we may consider that the late Board considered them as urgently necessary. The French have also four torpedo-vessels building of a larger class. It is probable that with Admiral Aube’s, the new French Minister of Marine, well-known partiality for the torpedo, we shall have our neighbours making a fresh start in building torpedo-vessels and boats at the expense of ironclads.

These novel vessels will in my opinion act a very important part in future naval actions and operations, so that I have alluded to them at some length, but I come now to the ironclads. Our ironclads have not changed materially lately, and the special points in their structure which have evoked criticism have been ably dealt with by Sir E. Reed and Captain Fitzgerald in this theatre; I am also anxious to confine myself to questions directly connected with tactics. As

bearing upon this the armament of our ironclads is important, and considerable changes and modifications in armament have taken place, and are daily being developed from the advance of the torpedo attack. The torpedo attack was favoured by the armament of the ironclad, which consisted ten years ago solely of heavy armour-piercing guns. The "Thunderer," for instance, even six years ago carried two 38-ton and two 35-ton guns in her turrets, but if we except a Gatling in the top she had positively no other defence except small-arm fire. This was evidently a dangerous state of things which had never been accepted in foreign navies, but it was not till December, 1879, that the "Invincible" took out the first six Nordenfelt guns supplied to the Mediterranean. So rapid has the development of the anti-torpedo armament of our ships been lately, that the Nordenfelt 1-inch machine-gun hitherto in use in our Navy is already practically obsolete, and is being replaced by the 6-pr. Nordenfelt or Hotchkiss gun, and the 3-pr. shell-firing Hotchkiss or Maxim.

The armament intended for our new ships "Nile" and "Trafalgar," is, we are told, in addition to the two armour-piercing guns and eight smaller guns, probably $6\frac{1}{2}$ tons, to consist of eight 6-pr. quick-firing guns, and ten 3-pr. Maxim machine-guns, with probably four Gardners.

This is a formidable array of what I have heard irreverently called "gingals," but a ship thus defended is not the easy prey in the daytime at least to even a score of torpedo-boats which a "Thunderer" or "Dreadnought" would have been only six years since.

The 6-pr. Nordenfelt firing shell at the rate of ten per minute has already been described in this theatre, but the 3-pr. Maxim¹ which is I understand to be adopted in the Navy is worth more than passing notice.

Through the courtesy of the inventor I was allowed to inspect this wonderful little machine-gun in Hatton Garden a few days ago, and the following description of it may be of interest.

3-pr. shell-firing Maxim gun, single-barrelled, about 8 feet long; weight, 750 lbs.; charge of powder, 1 lb. 12 oz.; fires 60 shot per minute; cartridge box attached to standard holds 40 shell; muzzle velocity 2,000 feet.

Supposed to be good against torpedo-boats, 3,000 to 4,000 yards.

It is self-loading by the recoil as with the small 0.45 Maxim shown at the Inventions Exhibition last year, but in accordance with Admiralty requirement it fires by a pistol trigger, though it can be continuously fired by keeping a constant pressure on the trigger or button. It has a shoulder-piece and is elevated and trained in the same manner as the Hotchkiss, but the shoulder-piece is attached to a case, within which the trunnions work on a slide, the recoil being taken up by a hydraulic buffer.

I have stated that I am not inclined to go into the vexed questions connected with the structure of our ironclads, but there is one point of great tactical importance which I have not seen referred to. I

¹ I am told that this gun is only on trial at present, but I believe it will be adopted if it proves not to jamb or otherwise fail under the tests.

allude to the masking of the guns in the turrets of those ironclads which have them in échelon by the superstructure, which is a serious drawback to their fighting value. That a turret should have as nearly as possible an all-round fire used to be an axiom, and this desideratum has been obtained in our older turret ships "Dreadnought," "Thunderer," and "Devastation," but while the "Dreadnought's" four guns can be fired through an arc of 240° out of 360° , the "Inflexible" I believe can only fire her four for 96° . As I have no reason to believe that the "Inflexible" is in this respect inferior to the other modern double turret-ships ("Ajax," "Agamemnon," "Colossus," and "Edinburgh"), it shows the terrible price which practical fighting efficiency has been forced to pay to what I venture to call the "fad" of a nominal end-on fire.

Whilst on the subject of fighting efficiency and gun-fire, I wish that more attention were paid to the all-important question of smoke. Smoke on a calm day will shroud ships in action in an impenetrable veil which will give torpedo-boats opportunities for successful attack in comparative safety, while a dark cloud of smoke may make the "best laid plans" of Admirals to "gang aft agley," yet we know that sportsmen have succeeded in finding a powder which practically has no smoke, and we may hope that improvements in our gunpowder for heavy guns will have the same result in due course. I am told indeed that the brown powder made in Germany, and which we have not hitherto succeeded in making at Waltham Abbey, is practically smokeless, the carbonate of potash of which the smoke is composed dissolving easily in air, while with our ordinary black powder the sulphate of potash is not soluble in air, and must be dispersed by wind. A company has I hear been formed to buy up the German patent and make this powder at Chilworth, and I can only hope that the result may prove as great a success as is anticipated. It is certain that anyone who can invent smokeless coal and smokeless gunpowder will not only do an inestimable service to this country, but will also make his fortune, so I suggest to those overburdened with inventive talents to turn them in this direction.

In referring to the active as opposed to the passive defence of ironclads, mention must be made of the torpedo-boats she should herself carry, for though a fleet of torpedo-boats could always be attached to every fighting squadron, every big ship should be as far as possible self-supporting, and should carry at least two torpedo-boats capable of being dropped easily from the ship even when under weigh.

Here again is a field for mechanical invention, for the present plan of hoisting a flimsy steel boat out by a derrick makes it impossible to get her out or in except under specially favourable circumstances which cannot be expected to be those usually experienced.

It is a question too as to whether our second class steel boats of 62 feet length, which are those usually supplied, should not be replaced by more substantial wooden launches, such as Mr. White's turnabout boats, which would be useful for ordinary ship work, but I would not make any change which would entail a reduction of speed

on the measured mile below 15 knots, as if these boats are to be of service, their speed should not be inferior to that of the ship under favourable circumstances. With reference to the machinery for hoisting and stowing these boats, it has occurred to me that some plan similar to that adopted for paddle-box boats might be adopted, the boat being hoisted by chains and a steam winch, the chains passing through sheaves in davits which should be bent so as to fall inboard, being worked in and out by small spurs. It would be necessary to carry out this idea that the boats should be built with permanent slings as high as the gunwale which would enable the chain slings to be so short as to be easily handled.

I have endeavoured to explain my idea by the accompanying rough sketch, but I do not see much difficulty in carrying it out if the builders of our ships' torpedo-boats will only consider it important to lift the boats by the two ends instead of by the centre. The davits may appear cumbrous, but we must make some sacrifice towards attaining the end in view, namely, to be able to drop torpedo-boats quickly from our ships when necessary.

Let us now look at the passive defence of ironclads against torpedoes which rests mainly on her numerous watertight compartments, cofferdams, and cell construction, or what Admiral Sir George Elliot refers to as her raft body, and the question arises as to whether such protection can be of any avail against the torpedo. This is a large question, which can only be settled by actual experience in warfare, but it is certain that the last word in this direction has not yet been said, as Sir E. Reed's proposed armour-plated bottom and Admiral Elliot's proposed crinoline shows. It is true that our only experiment against a model of the "Hercules" bottom showed such a wonderful success for the torpedo, that, as Commander Gallwey told us, the charges of all locomotive torpedoes were reduced to 30 lbs., and that since that time they have been increased to 70 lbs., but we have the following from Commander Bainbridge Hoff, of the United States Navy, in his work on "Modern Naval Tactics," published in 1884, who as an intelligent American naval Officer may undoubtedly be looked upon as not prejudiced in favour of ironclads. "To us it appears as if the coming ship would be, as regards her keel, nearly if not quite torpedo-proof, through numerous watertight compartments, &c." Again, we have a French naval Officer, Lieutenant Weyl, writing only last year,¹ and giving the following account of some recent experiments made by the Italians at Spezia with the view of testing the strength of one of the new ships they were proposing to build, the "Sicilia." Lieutenant Weyl's account is as follows: "They moored in the harbour of Spezia a caisson representing a treble bottom in steel, being a section of one of their ships in project; this caisson, covered with an armoured deck and suitably trimmed, was sunk in such fashion that it was in a similar condition to the under-water portion of a ship to which it had belonged. On a torpedo being shot at this caisson, and exploded, the outer and inner skins were broken, but the third—the interior skin of the vessel—resisted admirably."

¹ "Questions Maritimes." Par Em. Weyl, Lieutenant de Vaisseau en retraite.

He then mentions that these experiments were continued on the same caisson, but with one cell filled with coal, the result being that only the outer skin was broken. M. Weyl remarks that this experience was conclusive, and it is certain that the Italians considered it as a victory for the ship, as orders were at once given to lay down the "Sicilia" and her sister the "Ré Umberto" ironclads.

It is, however, only fair to state that from other sources I have heard a different account of this experiment, which has been kept as secret as possible, this report saying that a section of the "Sicilia" was sunk horizontally at a depth of 9 or 10 fathoms, and 75 lbs. of guncotton exploded on it, the result being that the outer bottom was blown in and the inner somewhat damaged, but that the interior cells filled with small coals resisted. Whether such a trial as this effectually represented the explosion of a Whitehead against the "Sicilia's" bottom may be doubtful, but it is certain that the Italian authorities looked upon the result as a victory for the ship. The necessity for some similar experiments in England is, I am glad to see, at last acknowledged by the Admiralty, as the "Resistance" is to be coated with "cellulose," a fibrous substance said to have a wonderful property of closing up again when a hole is made in it, and torpedoes are to be fired at her, while the protection to be afforded by "coal armour," both above and below water, is also to be tried. It is natural to hope that the result may in this case, too, be a victory for the ship. The experiments will be looked forward to with keen interest, and it is another proof that the last word has not yet been said on the subject of protection against torpedoes.

I have only further to consider the nets now fitted to our ironclads as means of passive resistance against torpedoes. There is a natural inclination to laugh at them as unpractical, they take up room, they are an awkward encumbrance to movement, the Commander finds that they are an interference with royal yard drill, and that they scratch the ship's side, the Staff Commander fears that they will foul the screw, the Dockyard authorities find them a tax upon their ingenuity as well as a source of expense for which they get little immediate return, yet slowly but surely they are being adopted, the difficulties of working them are being overcome, and their importance is being acknowledged. The problem of getting these nets out is being effectively solved in the Mediterranean Fleet under Lord John Hay, who has given much attention to this important question. I do not know if the bow and stern defence, several plans for which were being tried a year ago, has been settled, but I know that the broadside defence by nets has been successfully carried out. In the "Dreadnought" we had a broadside defence fitted according to a plan of Staff Commander Miller, and I was able to steam with it at a speed of 8.5 knots without danger, though at that speed the nets undoubtedly "sagged" aft considerably. The plan can scarcely be explained in few words, but I may mention that the ship answered her helm well when using the nets, the loss of speed being only about half a knot, and that when they were once out they could be brailed up and the booms run fore and aft in about one minute, or got out

again equally quickly; also that with the booms fore and aft they could be carried, as indeed they were carried in the "Agamemnon," without material damage in bad weather. M. Gabriel Charmes,¹ indeed, in his enthusiasm for the torpedo, makes very merry over the large masses of ironclads with their crinolines encumbering their every movement, which would make them sure victims for the ram, but as his future fleet is to consist solely of torpedo-boats, lightly armed cruisers, and small gunboats, I do not see where the ram is to come from, and I quote his opinion now as showing the shifts to which extreme advocates of the torpedo are driven.

I have endeavoured to consider the torpedo and the gun as its active opponent, as they exist at present; I have also touched on the ship's structure, on her defence by torpedo hunters, by her own torpedo-boats, and by nets, but there remains the electric light, the proper use of which will be referred to both in treating of foreign and English sham fights and naval manœuvres. I must, however, remark on the great improvements which have recently taken place in the power and efficiency of the electric search lights carried by our ships.

A few years since most even of our ironclads carried a weak electric light, with one or at most two projectors; now not only has the light itself been much improved, but the number of projectors is to be increased to four in each ship.

The proper place for the electric light has also formed the subject of experiment, and I understand that in future it will be placed low down, below the guns if possible, which I believe will be a decided improvement, as hitherto the endeavour has been made to raise the light higher and higher, in the vain endeavour to overlook all obstacles, there being not a very healthy rivalry in most of our ships between the electric light and the standard compass as to which should be nearest the maintop. Something more is required to enable the carbons to be automatically adjusted, and if the projector could be worked at a distance from the light the boat or object lighted up would be followed more easily. I think, too, that all our ships, except perhaps gunboats, should be fitted with the electric light, and that at least one steamboat in each ship should carry the electric light as is the case in the Russian and other navies. When and how the electric light should be used is an interesting question, and one which I had some opportunities of studying whilst in command of the "Dreadnought," but I will only say here that the blinding effect of the light when turned upon a boat at night makes it quite impossible for the Officer in command to appreciate distances, or to see what he is doing, which is a strong argument in favour of using the light.

There are other questions intimately connected with tactics to which I have only time to allude, there is the best size for our fighting ships and the use of the ram. On the first point I am daily becoming more and more convinced of the importance of speed. If, as I think, the improvements of torpedoes have brought the gun and

¹ "Les Torpilleurs autonomes et l'Avenir de la Marine," par M. Gabriel Charmes, 1885.

manœuvring into a more prominent position, I hold that speed must remain a primary factor to be considered, for manœuvring power in the open sea means speed in most instances. I cannot, therefore, agree with Sir George Elliot and others who would, in order to keep fighting ships as small as possible, sacrifice speed.

From this point of view I do not see how the size of battle ships is to be limited if the ships are required at all, and at all events I am on the side of the big ship, as Moreau was on side of the big battalions. I deny the possibility of reducing this question to a pecuniary standard; if the big ship is to be complete in herself, and to perform the duties demanded of a line-of-battle ship in old days, she must have size or she will display decided weak points in one direction or another. That special vessels of various classes intended either for speedy torpedo-vessels, heavy battery ships of slow speed for attacking batteries, small gunboats, torpedo depôt ships, swift cruisers and torpedo-boats of various classes should coexist with the battle ship goes without saying, but these special ships will frequently find themselves in positions when their speed, or their gun-power, or their torpedoes, or their rams are useless to them, and I do not believe that the empire of the seas can be safely entrusted to a fleet of non-descripts forming a sort of "happy family" of contradictory qualities.

There remains the ram, of which I feel inclined to say as an old friend—

"Be to my virtues ever kind,
And to my faults a little blind."

I must, I am afraid, put the ram a little in the background, at least at the commencement of hostilities between fleets, so in spite of the interesting nature of experiments in manœuvring, circle turning, and other questions of importance in handling a ship, I must cut short this part of my subject with the remark that although my old friend may have fallen somewhat behind, I consider that it is a most important weapon, and that the ram-bow of our ships should be at least as strong as that of the ships of any foreign Power.

A short summary of the result of some experiments made whilst I was in command of the "Dreadnought" may be interesting. Probably the whole table will be printed, but the important points ascertained were that the diameters of the circles varied only a few yards, while the average time of completing the circle was 4 minutes 32 seconds at 13·5 knots, and 5 minutes 17 seconds at 11·2 knots. The drift angle was 8° to 14½°.

I conclude my general remarks on ironclads by a list of those recently ordered in England and by different foreign Powers, which shows the policy which is being adopted with regard to ironclad shipbuilding.

England.—In 1885, "Renown" and "Sanspareil," 10,500 tons, "Nile" and "Trafalgar," 12,000 tons, besides six belted cruisers of 5,000 tons "Narcissus" class.

Italy.—Two ships laid down in 1885, viz., "Sicilia" and "Ré Umberto," 13,000 tons, 400 feet length, beam 75 feet; these ships are not to have any side armour, but are to carry four 106-ton guns

mounted in pairs in barbette towers, armoured with $21\frac{1}{2}$ inches of armour, and to carry several light guns.

Russia.—One armour-clad laid down end of 1884, a belted ship called "Alexander II," 8,637 tons, length 326 feet, beam 67 feet, speed 15 knots. Armour 14 inches, tapering to 6 inches at bow and stern; armament, two 12-inch guns in a barbette armoured with 12-inch and 10-inch armour; four 9-inch and eight 6-inch B.L. on main deck, unprotected.

France, Germany, and Austria have not laid down any ironclads recently.

The great tactical question of the day is clearly that of whether big ships and fleets are to continue to exist or whether they are to give place to torpedo flotillas, at least as far as combats in the open sea are concerned, whether, in short, a future naval action is to resemble more or less the engagements of Rodney, Nelson, or Suffren, or whether they are to be a mixed medley or *mêlée* of small craft like Actium or Lepanto.

The views in favour of this latter notion have been put forward with much ability by a French writer, M. Gabriel Charmes,¹ who assures us that ironclads are doomed, that a maritime war will in future consist in the bombardment of defenceless towns by small gun-boats, by the ruthless capture or destruction of an enemy's merchant vessels on the high seas by fast cruisers, and by torpedo-boats covering the seas, who will sink and destroy all large fighting vessels. Having satisfied himself that these views are correct, he adds: "At the present hour, the empire of the sea that the squadrons disputed with each other formerly, is nothing more than a senseless word." He seems also to agree with Sir Thomas Brassey² that the torpedo is the arm of the feeble, and he supports his argument by certain calculations or miscalculations into which I need not now enter. All this will sound "very pretty fooling" to the members of this Institution, but as M. Gabriel Charmes professes to found his conclusions on the writings of an ex-Minister and the present Minister of Marine in France, it is worth while to examine shortly the views of these men, who certainly write with much ability, and who are occupying or have occupied responsible positions. M. Gougeard's³ views are that everything is in future to depend upon floatability and speed. The ironclad he gives up as no longer a useful tool, but he cannot bring himself to believe that mere torpedo-boats, which he compares to the fire-ships of the 17th and 18th centuries, will be the fighting vessels of the future. They are nothing but nutshells, he says, and they will disappear like the fire-ships when sufficient speed is given to other vessels. His conclusion is that a future navy will need a few heavily-armed slow ships for attacking forts, and he proposes vessels something similar to the "Scout," of 1,780 tons, with a speed of 20·5 or 21 knots, as "*navires de haute mer*." That M. Gougeard is

¹ See "Revue des deux Mondes," "La Réforme de la Marine," "Les Torpilleurs autonomes," &c. M. Gabriel Charmes, 1884-85.

² "Nineteenth Century," January number.

³ "La Marine de Guerre," 1884.

somewhat theoretical is evident, but it will be seen that his views are far removed from the conclusions of M. Charmes.

Admiral Aube's theories,¹ as those of a naval Officer and one who has at present opportunities of carrying them out, are of still greater interest. He is even more cautious than M. Gougeard, and rather hints at than directly proposes the abolition of ironclads. He believes implicitly in torpedoes and in fast cruisers, while he thinks that in consequence the sovereignty of the seas is rather a word than a fact, he laughs at the rights of war as illogical, and expects that maritime power "in default of adversaries evading their blows, will attack all seaport towns, whether fortified or not, whether peaceful or warlike, will set fire to them, ruin them, or at least will ransom them without mercy." He further sums up in favour of 5½-inch guns, with their range of 7,200 metres, as sufficiently powerful for the above purposes, a conclusion which I shall show later Captain Chaband-Arnault disputes after the experience of the River Min. It is curious that neither M. Gougeard nor Admiral Aube agrees with M. Charmes on the money question, for while the former says that "only rich nations can pretend to have dominion over the seas," the latter says that in "the present day more than ever money and boldness are the first elements" of naval victories.

These examples show the drift of intelligent foreign opinion on this important subject, and though in this country no similar views have been put forward in print, I think they are shared by not a few of our young gunnery and torpedo Officers, and it is fair to admit that both the screw line-of-battle ship and the ironclad first found favour in France.

There is and can be only one real test of these theories, viz., actual warfare, so I propose to refer briefly to such experience as is at our disposal. Let me take first the capture of the Peruvian monitor "Huascar," in the Chilian-Peruvian War, a good account of which is given in Commander Bainbridge Hoff's work.² The case of the "Huascar" was a victory for the gun, as she was captured through the loss of all her principal Officers and a large portion of her crew. She sustained little damage below water and was safely taken into port. It was the old story of a naval action but fought with modern arms. Her two Chilian opponents, the "Cochrane" and "Blanco Encalada," got her between them and she fell a victim to their superior gun-fire.

Lieutenant Mason, U.S.A., whose report Commander Bainbridge Hoff quotes, considers that in this action the Whitehead or any other divergent system of torpedoes would have been "suicidal and dangerous," while no opportunity was afforded for using the ram. He also points out the "Huascar" was much handicapped by not having an all-round fire, which necessitated sheering to bring her guns to bear.

The French operations against the Chinese in the River Min and at Sheipoo in 1884-85, although conducted with much ability by the

¹ "Revue des deux Mondes," 1882, &c.

² "Modern Naval Tactics," 1884.

late Admiral Courbet, would be scarcely worthy of notice but for the fact that M. Charmes has loudly appealed to them as victories for the torpedo.

Fortunately M. Chaband-Arnault¹ has given us a sober account of the River Min operations, from which it appears that on the 23rd August, 1884, at the commencement of hostilities two torpedo-boats armed with outriggers slipped from under the shelter of the French ships, and succeeded in destroying two Chinese gunboats, the "Yang Woo" and "Foo-Poo," in broad daylight, of which he speaks as follows:—

"Our boats had, in fact, the good fortune to be posted before hostilities commenced at 400 metres from the enemy, and traversed this distance before the Chinese could make up their minds to fire either gun or rifle at them. The ships, too, were stationary, had no machine-guns of any kind, and no external defence. . . . It would be dangerous indeed to run away with the idea that such an attack could be carried out against the ships of any navy except the Chinese."

Another case of torpedo attack is quoted by Captain Chaband-Arnault, who tells us that—"At 4 A.M. on the 25th August, 1884, two Chinese torpedo-boats attempted a surprise. The first steered for the gunboat "Vipère," which was anchored at the head of the French line. . . . Seen by a look-out on board the French ship, who fired a rifle shot at her, she changed her course for the "Duguay Trouin," which alone, except the "Triomphante," carried the electric light. Thanks, however, to these beams, the "Vipère" was able to point her Hotchkiss with such celerity and precision that the boat was sunk in a moment. The second boat shared the fate of the first."

"Certainly," remarks Captain Chaband-Arnault, who quotes M. Charmes' airy ridicule of the use of the electric light, "the electric beams, with the hail of small shell poured by the Hotchkiss, will not always suffice to protect one or several ships against fast torpedo-boats when well handled. But it is permitted to affirm that often they will contribute strongly towards obtaining this result."

The attack on two Chinese vessels in Sheipoo Roads on the night of the 15th February, 1885, of which a somewhat exaggerated account was given in the "*Revue Maritime et Coloniale*," turns out to have been of very doubtful importance.² The attack was made by two small steamboats of slow speed, belonging to the "Bayard," who succeeded after some difficulty in finding the frigate the "Ya Yuen." It appears that both boats, though acting independently, exploded their torpedoes under the counter of the frigate, which sunk. The "Tchen King" was sunk by shot fired from the shore when the attack took place. The list of damages to the boats, chiefly by fire from the shore, is as follows:—No. 1 boat received 11 projectiles, which fortunately wounded no one; No. 2 received 6 projectiles, one of which killed Fusilier Arnaud. It is worth remarking that both in this attack

¹ "Combats de la Rivière Min." Ch. Chaband-Arnault, "*Revue Maritime et Coloniale*," 1885.

² "Admiral A. Courbet," par A. Gervais.

and in the one in the River Min a boat got her outrigger jammed in the enemy's ship, and that there was difficulty in getting clear, which must have cost the lives of all the boat's crew against any European enemy.

Some remarks of Captain Chaband-Arnault on the River Min fights are worth repeating. He quotes the damages done by the gun to the upper works of the Chinese ships, while their floatability was not endangered, as an argument in favour of protecting the guns and guns' crews by armour, and he also points out not only that the 5½-in. guns of the smaller vessels were useless against the Chinese batteries, but that Admiral Courbet in his official report stated that he did all he could with these small guns of 14 c. "We wanted," he says, "guns of 24 c., or at least of 19 c."

I have explained why I have thought it necessary to dwell in some detail on these operations, and I recommend any out-and-out partisans of torpedo-boats and gunboats to read Captain Chaband-Arnault's "*Combats de la Rivière Min.*" Let me turn now to peace experiments.

Our own experiments in Berehaven and Black Sod Bay last year are full of instruction, and I only trust that these naval manœuvres may be carried out yearly on a similar scale under a chief as bold and as skilful as Sir Geoffrey Hornby. It is unfortunate that the number of torpedo-boats available was so limited as to have afforded little opportunity of thoroughly testing their value, the whole number being twenty, viz., two 1st class, six 2nd class, and twelve 3rd class. These experiments are, however, to be shortly dealt with by Admiral Arthur, so I need only draw a few conclusions from the newspaper reports.

1. I see no reason for the popular belief that blockades are impossible in future, if the proper measures be taken by the blockading squadron, which should consist of at least three lines of ships, nor do I see much risk for blockaders from the enemy's torpedo-boats if their own torpedo-boats be numerous and efficient.

2. A fleet at anchor should always be protected by a triple boom defended by guns and mines.

3. The electric light when intended to protect ships at anchor should be used from special ships or boats throwing fixed beams, the distances of which from the ironclads should be known.

4. Guard boats if used should have special orders and signals, so as not to interfere with the fire of their own ships when they are attacked.

5. Special dépôt ships should carry booms and nets so as to enable booms to be rigged rapidly. This is specially necessary now that so many of our ironclads are mastless turret ships.

6. The old 1st class torpedo-boats, which I have placed in the 2nd class, are not fit to go to sea, and the attempt to make them accompany the fleet entailed much discomfort on the crew, and not a little real risk to the boats.

7. The necessity for numerous fast cruisers as look-out ships, and torpedo-boats and catchers to resist similar craft on the side of the enemy.

There were some interesting naval manœuvres carried out in 1884 and 1885 by the Austrians and Germans, with some less complete

ones by the French Mediterranean squadron, of which M. Charmes makes the most as victories for the torpedo-boats, to which I can only allude. Those of the Russian Government in 1884 represented a state of war, and must have been most instructive. A detailed account and remarks upon them is given in the July number of the "Edinburgh Review" of last year, which is well worth reading.

I propose, however, to give only one illustration of these peace manœuvres, which are occupying the attention of all the great maritime Powers, in which the Italian Fleet took part, though my account¹ must necessarily be a scanty summary.

The fleet was divided into two squadrons as follows:—

Eastern Squadron.—Ironclads "Principe Amadee," flag of Rear-Admiral Civita, and "Castelfidardo;" cruiser "Americo Vespucci;" despatch-boat "Vedetta;" and four 2nd class torpedo-boats.

Western Squadron.—*First Division:* Ironclads "Dandolo," Vice-Admiral Martini, and "Duilio;" cruiser "Giovanni Bausau;" despatch-boat "Colonna."

Second Division: Ironclads "Roma," Rear-Admiral Bertelli, and "Affondatore;" steam tank "Verde;" and five torpedo-boats.

The general plan of operations was under the direction of Vice-Admiral St. Bon, the idea being that the eastern or enemy's squadron had taken refuge in one of the anchorages to the north of Sardinia, that which was selected being the fine harbour of Madalena, much used by Nelson in the French war. On October 15th hostilities commenced by the western squadron leaving Cagliari, the "Bausau" and "Colonna" being look-out ships, torpedo-boats in tow of the ironclads.

Before daylight the "Bausau" had made out two hostile torpedo-boats by the electric light, which made off without attacking; it was calculated that they would have been a good quarter of an hour under machine-gun fire from the "Colonna." The attacking squadron wishing to form a base of operations anchored in the port of Liscia di Vacca on the 19th of October, at daylight, having during the two previous days made ample use of the torpedo-boats and steamboats of the squadron to search out the various bays and inlets surrounding the island of Madalena, while at night an inshore line of torpedo-boats and an outer line of ironclads blockaded the eastern squadron. It was difficult for the latter to guard all the entrances to the harbour, and two were found to be unobstructed by mines or booms. The eastern squadron seems to have had a boom round it, as one flotilla of boats of the attacking squadron was taken while reconnoitring it at night. From the 19th to the 21st the weather, which had been favourable, was bad, which rendered operations difficult, but several ineffectual attempts were made to surprise the blockaded squadron, which resulted in the loss of boats to the blockaders. On the other hand the "Castelfidardo" was put out of action by a fishing boat

¹ Summary taken from Account in French paper "Le Yacht," 5th December, 1885.

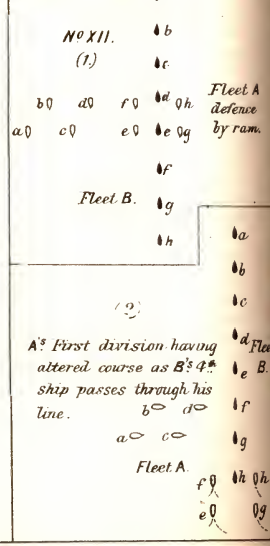
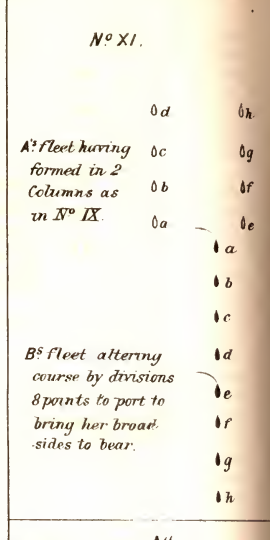
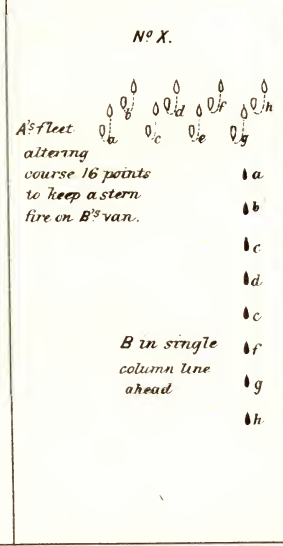
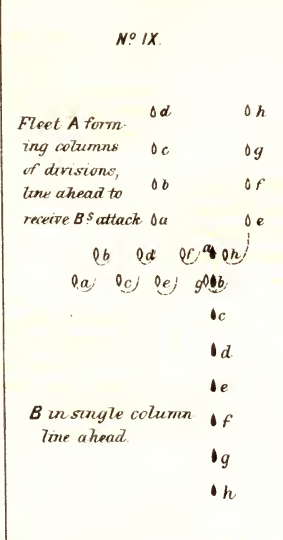
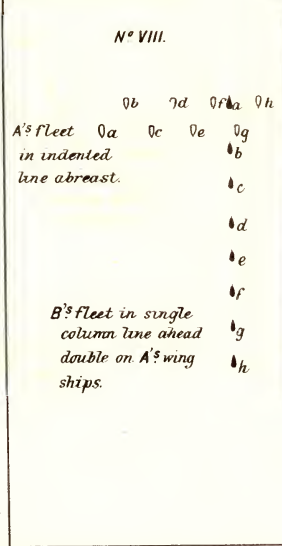
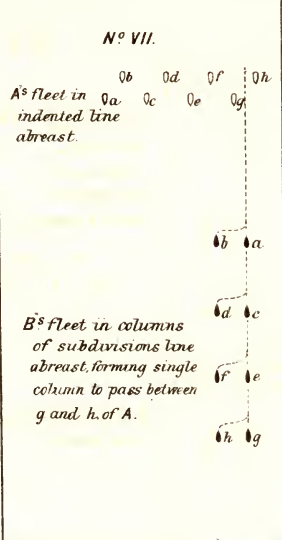
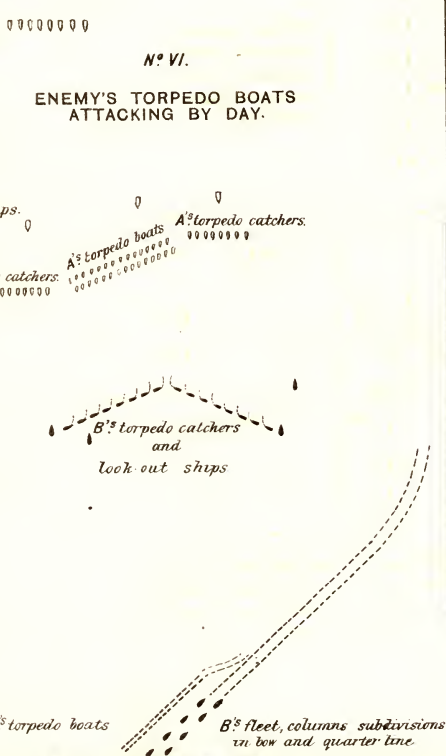
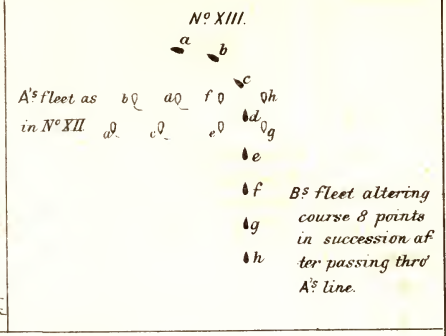
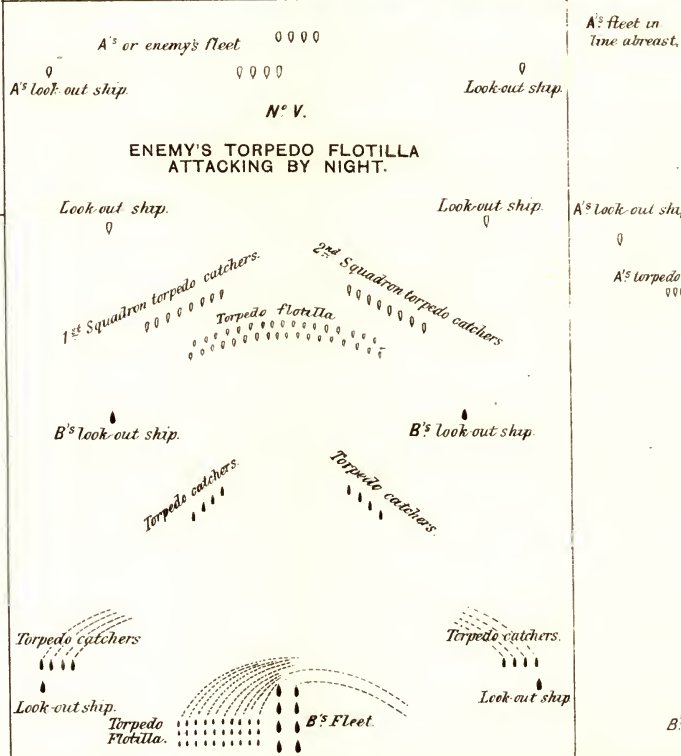
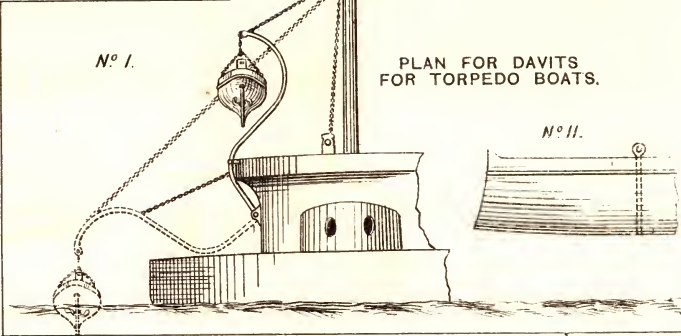
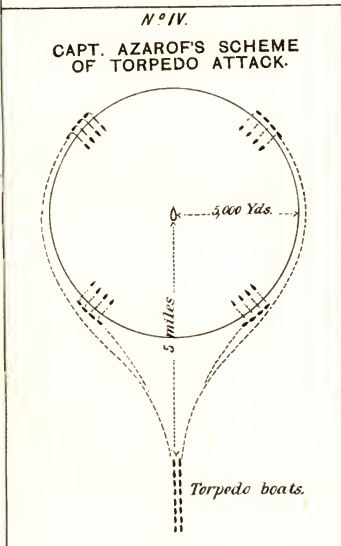
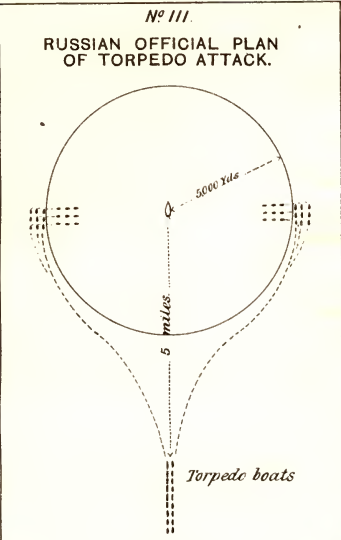
armed with a torpedo being unsuspectingly allowed to come alongside, which stratagem, I may remark, seems to me absurdly impractical, as the disguised sailors must of course have been shot as spies in real warfare, and it is enough to say that it could have been practised with equal success by Bushnell more than one hundred years ago, so that those detailed for such an enterprise would probably prefer "comfortably floating on the water," well clear of the enemy, as remarked by Mr. Nordenfelt about the occupant of Bushnell's diving-boat.

At the same time torpedo warfare seems to lead up naturally to similar "devilish" inventions, as they used to be called, and the moral is that every possible precaution should be observed. By this time the attacking squadron had lost most of its boats, and the blockaded squadron one big ship. Admiral Martini then arranged to make a night attack with his ships, disguising the "Verde" as an ironclad so as to draw the torpedo attack. But before he could attack, Admiral Civita attempted to escape by the Pass of Nido d'Aquila, where the south-west corner of Madalena approaches Sardinia; here, however, though the night was dark and windy, they were met by an enemy's torpedo-boat which was taken, but gave the alarm, and brought the "Duilio" on the scene, to which the "Amadeo" and "Vedetta" hauled down their colours after a brief action. This necessarily incomplete account of operations, not very complete in themselves, as the Italians had no net protection and were deficient in cruisers and torpedo-boats, shows how eagerly naval Powers are seeking a solution of the varied problems connected with naval tactics.

From the previous remarks my idea of a modern fleet may be easily gathered.

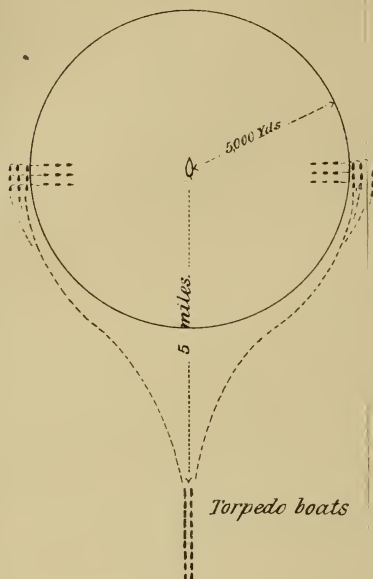
It certainly cannot depend solely on ironclads. Indeed a squadron consisting of ironclads alone is essentially a notion resulting from a long peace. Nelson before Aboukir bitterly complained of the lack of frigates, and stated that if he died the word frigates would be written on his heart; the "Pickle" schooner may be seen among the line-of-battle ships in the Trafalgar Model of this Institution; and when I first went to sea, Sir W. Parker's squadron in the Mediterranean was usually escorted by as many steamers and small vessels as it had line-of-battle ships. Now clearly, look-out ships and fast cruisers, as the eyes of the fleet, are more than ever indispensable. I therefore submit the following as a suitable proportion for a fleet of the present day intended to act at sea. If acting inshore gunboats and coast-defence vessels would necessarily be added. Assuming an ironclad fleet of twelve ships as the basis, the numbers should stand about as follows:—

| | |
|---|-----------|
| 12 ironclads, say | 6,000 men |
| 4 frigates ("Leander" class) | 1,600 " |
| 12 "Scouts," look-out ships | 3,000 " |
| 24 "Grasshoppers" (torpedo-catchers) .. | 1,500 " |
| 50 1st-class torpedo-boats | 750 " |
| 2 torpedo depôt-ships | 600 " |
| <hr/> | |
| Total. . 104 ships. | 13,450 " |



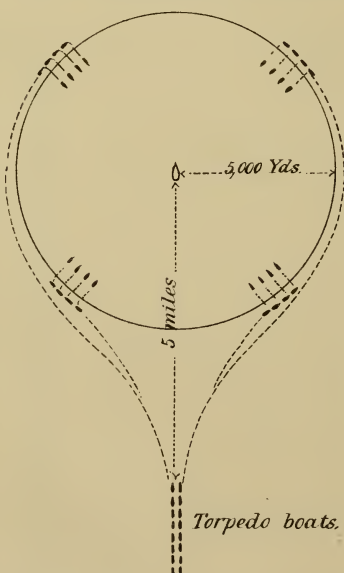
N^o III.

RUSSIAN OFFICIAL PLAN
OF TORPEDO ATTACK.

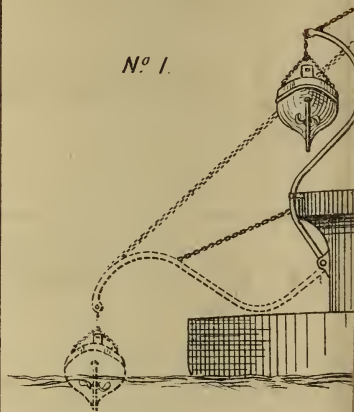


N^o IV.

CAPT. AZAROF'S SCHEME
OF TORPEDO ATTACK.



N^o I.



A's or enemy's fleet

A's look-out ship.

ENEMY'S TORPEDO
ATTACKING

Look-out ship.

1st Squadron torpedo catchers.

Torpedo

B's look-out ship.

Torpedo catchers

Torpedo catchers

Look-out ship.

Torpedo
Flotilla.

Our fleet, therefore, would consist, in round numbers, of 100 craft, half of which would be torpedo-boats, and about 13,000 men.

Now for the organization and evolutions of the fleet, and I think I hear some of my naval friends muttering, "I thought so, that is a big question which may well take him to the end of his lecture." So I say at once that, important as these points are, I can well afford to leave them with only a few remarks. I am generally content with the organization of our fleet into two, three, four, or five divisions, and each division being divided into two subdivisions, but I fail to see why each division could not be divided into four subdivisions, should the Commander-in-Chief prefer. (This would, I am aware, require a few additional signals.) At present, with sixteen ships, should the Admiral prefer to fight in pairs, he can only make his pairs subdivisions by forming his fleet into four divisions, which when in columns of divisions line ahead would occupy an extended front of 2·4 miles. I should myself prefer sailing in two columns 1·6 miles apart, but I could not then have subdivisions of less than four ships.

These are questions, however, which can be better discussed with the Signal Book before us, and by a Committee of experts at the Admiralty. It is more to the purpose that I see little advantage in dividing the fleet into threes, and that I see none whatever in the service groups, except as an evolutionary trap for the unwary.¹ Their origin, their history, their variations, the unremunerative time and thought expended on them should be argument enough. I do not think them worthy of serious consideration, but if any Admiral of experience informs me that it is a formation which he would adopt in preference either for sailing or fighting, I am, of course, ready to reconsider my opinion.

The torpedo-catchers and torpedo-boats should, I hold, have separate organizations, a junior Admiral, or Commodore, being in charge in each case. The 24 "Grasshoppers" I should divide into 3 or 4 divisions, the 50 torpedo-boats into 4 divisions, leaders of divisions to have pole masts for signal purposes. These vessels should cruise separately from the fleet under their own Commander, who should be responsible for all details, and only a few simple movements should be attempted.

The whole to be under the orders of the Commander-in-Chief of course.

As regards evolutions, I think our system of rectangular movements decidedly superior to that generally followed in the French Navy, which consists of oblique movements.² We should, I hold, always be in some formation night or day, during fog, leaving or entering harbour, or at anchor. If when at anchor the Admiral prefers to place himself in a special position, the fleet should weigh in that formation and assume any prescribed order afterwards by a proper evolutionary movement, the practice of weighing independently, and form-

¹ See Lieut. Farret, "Revue Maritime et Coloniale," 1883.

² See some very interesting articles in the "Revue Maritime et Coloniale," 1883. By M. Farret, Lieut. de Vaisseau.

ing outside the port, being a relic of sailing days, when the "outward-and leeward-most ships" necessarily weighed first, though of course it may still be necessary in a close harbour like Malta. This is the course generally now adopted by our best Admirals.

A word about signals. Our present flag signals have stood the test of years of evolutions, and have scarcely been changed for the last quarter of a century, but they are inapplicable to action in the present day, for the simple reason that while guns' crews and Officers in conning-towers are more or less fully protected, the signalman, his halliards, and his flags are exposed to machine-gun fire. The semaphore has been tried for evolutions, and if the semaphore can be fairly trusted I would suggest a plated tower for the signalmen, or a portion of the conning-tower being kept apart for their use, whence a large semaphore could be worked in action. It has been suggested that the arms of this semaphore should be worked from the top of a "military mast" in our turret ships, which seems worth a trial.

I come now to pure tactics, say 1 to 1 of equal force. This has been well threshed out on previous occasions. It will generally be decided by the gun, as I hold that, at first at least, ships will mutually avoid the chance of a fatal torpedo shot, and for this reason a ship will endeavour to keep rather before the beam of her opponent if broadside to broadside, or if circling round she could keep either near the enemy's bows or stern, according as her own bow or stern fire was the stronger.

In either case speed is of the first value. In a single ship action I should certainly advocate the use of torpedo-boats if they could be prepared in time; they would keep under shelter of the ship till the opportunity offered of making a successful dash under cover of smoke. It is essential that the torpedo-boats should have superior speed to that of the ship. A ship with better manœuvring power but inferior in other respects should try to ram at once.

It is more important to consider the attack of an ironclad by torpedo-boats, which has been much discussed in Russia.

In the Russian naval magazine of December last a Captain Dubuzof discusses some plans of attack of a Captain Azarof, which differ somewhat from the recommendations in the Russian Official Manual for Torpedo-boats. The manual adopts eighteen boats in two lines as a squadron, and recommends that each line should form three lines abreast (see Fig. III), endeavouring to get abeam of the ship to be attacked, when all bear down together. Under such tactics each line of boats would be in danger of being enfiladed by the ship. Captain Azarof's scheme consists in dividing the two divisions into four squadrons, say, of four boats each, the boats then keeping outside of the range of the ship's guns, endeavour to form on the circumference of the circle either N., S., E., and W., or N.E., S.E., N.W., and S.W. of the ship as ordered, and when in their positions all bear down on the ship together. It will be seen that each squadron will thus be in line abreast and no enfilading is possible (see Fig. IV). Azarof thinks that the best tactics for the ship would be to steer direct for one of the squadrons. Anyhow the ship

would be in a critical position, as the squadron steered for might separate, and two boats at least would get easy shots. It would, however, be difficult to make the attack simultaneously, as the squadrons would be 3 miles apart. Under ordinary circumstances a ship attacked by only one or two torpedo-boats would turn her stern to them so as to keep them under fire as long as possible, and from astern when firing at a ship steaming 14 knots the torpedo would have to be fired at about 150 yards to ensure its reaching her.¹ I do not myself contemplate torpedo-boats attacking squadrons or even single ships in broad daylight or under favourable circumstances for the ship; they would naturally choose darkness, fog, or smoke. The attack in the daytime might succeed, but the sacrifice of life, though lightly spoken of, by civilian writers especially, would be too great, and men are easily demoralized when under fire and unable to make any return.

I do not, therefore, assume an attack by a flotilla of torpedo-boats and vessels on a fleet when undefended by torpedo-boats, but it is probable that the old half-moon formation of the Venetian galleys would be the best, care being taken not to allow the horns to be enfiladed by the wing ships. It would be folly to expose our costly ironclads to such an attack, but I believe it would be repulsed with great loss of life to the assailants, although I admit that they might sink a ship or two.

On the other hand, at night the advantage would rest with the torpedo flotilla in such a case.

Now let me consider how an action would be likely to be fought between my ideal fleet composed as I have proposed, and one of similar force.

I do not believe that torpedo-boats would act as skirmishers, or that they would rush past each other to the attack of the ironclads, as supposed by Admiral Elliot.² The view taken by the author of the Battle of Port Saïd³ is, I think, more probable, but I do not suppose that it would be advisable for the ship's torpedo-boats to be hoisted out, and to attempt to keep with her in a general action, as suggested by him.

The enemy might try a torpedo attack with all his small vessels at night as a surprise; in this case the look-out ships and torpedo-catchers which would be acting as the eyes of the fleet would at once attack them and endeavour to throw them into confusion. The fleet attacked would do best probably by not firing a shot, but by changing position rapidly in line of battle, or columns of two divisions two cables apart, and keeping their own flotilla of torpedo-boats between them and the enemy's. Should the torpedo attack fail, or a confused fight ensue, then would be the time for a counter torpedo attack on the enemy's fleet, if its position were known. The difficulty of arranging signals so as to distinguish friend from foe would in any case be great in such a *mêlée* of small craft, and the principal endeavour

¹ A 20-knot torpedo-boat coming up astern of a ship steaming 14 knots would be 6' 15" within 1,500 yards, or under easy machine-gun fire.

² "Future Naval Battles and how to Fight them," 1885. By Sir George Elliot.

³ Battle of Port Saïd, from "Engineering," July 1883.

should be to avoid panic and confusion. The torpedo-boats having little offensive power, the torpedo-catchers would do as well without them as with them, and it would be advisable to keep the torpedo-boats in hand till they could act on the offensive with effect (see Fig. V). Should a similar attack be attempted by day, which I think improbable, the tactics would be somewhat the same; but I hold that a skilful Commander-in-Chief would probably endeavour, even at some risk, to cut off the enemy's torpedo-boats (see Fig. VI). It is possible again that the enemy might use his torpedo-boats as skirmishers, supporting them with his battle ships; in that case when our Admiral saw that the torpedo-boats were keeping near their own ships, he would probably recall his torpedo-catchers, and trust to his gun-fire, which could not well be returned by the enemy without danger to his own boats.

I do not suppose from the above that our possible enemy will be less wary than ourselves, but I wish to show that some popular views are mistaken as to the part likely to be played by torpedo-boats in a general action. I think with the author of the "Battle of Port Saïd" that they will act as a sort of reserve when favourable opportunities offer, always assuming that both fleets are on even terms as regards numbers of torpedo-boats.

I think then that an action will be commenced by the ironclads and heavy rams of the "Polyphemus" type, and that from fear of the torpedoes carried, it will begin by skilful manœuvring, the gun being the principal weapon. Should this be the case, speed, as I hope to show, is of the highest importance.

I have now simplified my problem by reducing the question to a fleet action between ironclads, the gun being the chief weapon; but I would add here that the ram would naturally be used in self-defence, and torpedoes would be fired as opportunity offered.

To consistency with what I have formerly advocated I make no claim, except as regards main principles. These are that the Admiral must choose the weapon with which he will fight and subordinate his tactics to that choice.

"There is no making of omelettes without breaking of eggs," and there may be several ways of breaking them, but a cook who hesitates how or with which particular instrument he will break them, will probably find that a rival has meanwhile made his omelette. This is a homely illustration of Tegethoff's success at Lissa. He chose the ram as his weapon, and made use of it while Persano was hesitating.

So much for principles. The detailed suggestions for tactical fighting formations have varied considerably, though writers have usually very properly made them subservient to the weapons on which they intended to rely. A review of these opinions would be most interesting, but I have only space for a brief summary.

Both foreign and English writers have generally assumed line abreast or some modification of it, such as indented lines abreast, or lines abreast by divisions as suitable to ramming tactics, while those who have advocated reliance on the gun have gone back to line ahead

or some modification of it. Thus the French Admiral Bourgois, writing in 1876, advocates one line abreast, one cable between each ship for attack by the ram, and this has been very generally adopted by French writers, Gueydon, Penhouat, and others.

Captain Colomb, R.N., as long ago as 1872, went back to line ahead (the old line of battle), so as to "double on the enemy," using his guns. Lieutenant Grillo, of the Italian Navy, writing as late as 1881, distinctly prefers line ahead for a gun action; he is against line abreast, and he considers the form of three ships affecting a triangular form to have scarcely any military value.

These are examples taken almost at random, but in spite of numerous exceptions and some neat but unpractical ideas such as that of the naval square of Admiral Bouet-Willaumez, which have made thinkers like Jurien de la Gravière sum up "that there is no fundamental order of battle, but that bows must be pointed towards the enemy," the rule stands out clearly, "For the ram use your bows, for the gun use your broadside."

That one view must modify the other is evident, for no Admiral would dare to commit the mistake of the Italians at Lissa of exposing their broadsides to the rams of a hostile fleet, and a long line must be in danger of having its extremities overwhelmed by a better concentrated enemy. On the other hand, a concentrated force masking their own guns would form a good mark for ships in line of battle. There is no more reason why a fleet with a broad front should not be employed to meet one attacking with a narrow front than that a battalion in line should not meet one attacking in column.

Let us now follow one or two ideal movements. Squadron A (see Fig. VII) is in indented line abreast, and is met by a Squadron B in columns of subdivisions line abreast. Squadron B, when at about ten cables distance, forms single column line ahead to starboard, and passes between A's *g* and *h*. The object of B was to crush the three wing ships of the enemy by pouring sixteen broadsides into them. On the other hand, A's squadron would have poured a heavy bow-fire into B's van ships as they came up. (See Fig. VIII.)

This or some similar movement was actually carried out between opposing squadrons under Sir G. Hornby last year. The Admiral of A should, however, be prepared for this, and he could either alter course sixteen points and form columns of divisions line ahead on *d* and *h*, thus endeavouring to get the head of B's column between two fires (Fig. IX), or by simply altering course sixteen points he would keep the stern fire of his eight ships on B's van (Fig. X).

In either of these cases A would avoid the torpedo. Supposing, however, that the Admiral of A decides to use the ram, and that his orders were that his ships should act in pairs, in readiness for such a movement as B's, *g* and *h* and *e* and *f* would have been ordered to form line ahead, thus forcing B to go inside the two former, and he would have to fight four ships instead of two or three. If A's first division were to alter course eight points to port, as the 4th ship of B passed through, they could either ram B's two rear ships or surround them (Fig. XI). Any of these movements would have to

be concerted beforehand, and would, I think, place B in an awkward position.

No. (1) would be most effective probably.

„ (2) would be simplest.

„ (3) the most dangerous.

Should B perceive that A has adopted or is intending (1) or (2), he would probably alter course in succession eight points to port, and so bring his broadsides to bear, but A in that case altering course eight points to starboard would bring a heavy fire to bear on B's van ships as they came up, A's better course would be to alter course eight points by divisions, but his first division would in any case suffer (Fig. XII). An answer of B to the (3) movements of A would be to alter course eight points in succession to port as he passed through A's line. (Fig. XIII.)

These illustrations serve to show the weakness of the long line, a weakness of which now as formerly a skilful enemy can always avail himself in spite of its theoretical value. It naturally increases according to the number of ships. It may be fairly strong with six, weaker with eight, dangerous with twelve ships. The indented line which I have referred to is that practised in our Navy.

There are two in use, and I have taken the one that is least objectionable, but I do not like either. Greater flexibility with much the same formation can be obtained by columns of subdivisions of two ships in bow and quarter-line.

To carry out evolutions (1) or (2), at superior or at least equal speed, good turning-power and a powerful stern-fire are indispensable.

I am afraid that vessels like the "Renown," "Sanspareil," "Conqueror," or "Hero," with their bow-fire only would, to use the ordinary phrase, be rather "out of it." It is evident that an attempt of B to force A's centre would be more easily frustrated than an attack on the wing ships. In meeting an enemy formed in line ahead, I should prefer columns of subdivisions in line abreast, leaders of subdivisions at four points bearing. This formation seems to me flexible, and to give better mutual support than the indented line ahead. Probably some such formation, but divisions in line abreast, would be best in meeting an enemy formed in line abreast. In either case an alteration of four points would bring all broadsides to bear.

Simple compass signals only would be used to denote the course while manœuvring in action, a distinction being arranged between altering course "in succession" and "together;" ramming or torpedo attack would follow the gun action. Ships should be ordered to act as much as possible with their pair.

With these experimental hints I leave the question of action tactics, but the most important point of all remains.

It is essential that the Commander-in-Chief should have decided in his own mind how he should use his weapons, and that his plans for foiling any attack of his enemy should be matured beforehand. The main principles and even the details of these plans as far as possible should be understood and appreciated by the Junior Flag Officers and the Captains of the Fleet.

This last was in great part the secret of Nelson's success, yet hidden as it were under the seductive qualities of personal heroism and dash, it needs to be often repeated.

Mr. Laughton quoted to us a short time ago Sir Edward Berry's testimony to Nelson's "masterly ideas on naval tactics, with which every one of the Captains of his squadron was most thoroughly acquainted," and exposed for the hundredth time the error as to Nelson's views, which has found common acceptance in the phrase attributed to him, that "no Captain could do wrong who placed his ship alongside one of the enemy;" the fact being that this phrase is not only inaccurately quoted, but that it appears at the concluding sentence of a long memorandum of instructions.

The Captains must have confidence in their chief, so as to understand him, to use Jurien de la Gravière's phrase, "*à demi mot*," mere good humour and courage will not give this confidence, which must be founded on the qualities of the Admiral in command.

There is an anecdote which I have perhaps read somewhere, though I think I was told it by an old Officer, which illustrates my meaning of the intimate confidence, that plant of slow growth, which should exist between Admirals and Captains, and which all our best Admirals have been able to inspire. A couple of days before Rodney's action in 1782, while the British and French fleets were in sight of each other in the calm tropical weather of the West Indies, one of Rodney's most distinguished Captains, who I will call Captain G., pulled alongside the flag-ship, and on seeing the Admiral, who was a personal friend, he implored him to let him go home, as he felt sure that he would disgrace himself in the impending action. Rodney, knowing that this was a mere temporary weakness, firmly but kindly sent him away at once, saying "Nonsense, G., do your duty as you have always done hitherto, or I shall try you by a Court-martial." Captain G.'s ship was hotly engaged in the action which ensued, and the Captain behaved with even more than his usual gallantry.

I am told that I ought to make some allusion to Mr. Nordenfelt's diving-boat, and to the effect which such inventions will have upon tactics. I have not done so in the lecture hitherto, as the greater part of it was already written when his lecture was delivered, and I looked upon his diving-boat as merely a development of the torpedo attack.

He gains in secrecy and invisibility, but loses in speed. His 100-foot boat will probably be more easily made out when with cupola above water than the smaller specimens. We may expect later on to hear of still larger and more conspicuous seagoing diving-boats. All inventions modify tactics, but I confess that, speaking generally, I am an unbeliever in cheap and easy ways of annihilating naval power, whether of England or of other nations. From Bushnell, Fulton, and "long-range" Warner, to M. Gabriel Charnes and Mr. Nordenfelt we have the same idea; yet booms and nets will keep out diving-boats as easily as other torpedo craft, and a diving-boat caught under water would make a nice Mahomet's coffin for her crew. The 300 lbs. dynamite torpedo, when it comes to fruition, can probably be made to

explode prematurely, and the boat might be "hoist with her own petard," as the Duke of Edinburgh suggested. Shortly, a diving-boat is to fight by stealth and to run away. It must be reckoned with, and will probably have its isolated successes, as have had other torpedoes which destroyed the "Housatonic" or the "Albemarle" in the American War, or the Turkish gunboats on the Danube, but Farragut pressed in at Mobile in spite of the loss of his leading ship by a torpedo, calmly saying, "What's the trouble?" and these successes have generally rather modified than materially changed naval tactics.

"He who fights and runs away may live to fight another day," but such methods must be ever subsidiary to that open fighting, which will eventually command the situation, either by sea or land.

The CHAIRMAN: Admiral Fremantle has given us a very extensive field both for discussion and thought. We shall be glad to hear the opinions of any one present who wishes to make any remarks on the lecture, bearing in mind that in the discussion over such an extensive field, it will be advisable to keep to the points raised; so many important questions have been brought to our notice, that if we ramble over or stray from the subject our discussion might be indefinitely extended.

Captain BETHELL: Sir Cooper Key, ladies and gentlemen, I do not propose to offer any lengthened criticisms upon the very interesting paper we have just heard, because I have not had the opportunity of studying it beforehand, and without such an opportunity it would be, I think, extremely improper to attempt any detailed criticism. There are, however, just one or two points that have occurred to me, and possibly to most other gentlemen here, in connection with those subjects at various times. One of these is the question of big ironclads. Admiral Fremantle holds the view, which I believe is held by many Officers in our profession, that the large ironclad ought to be and will be continued. Now it appears to me that that view, and I say this without any disrespect, is not in my judgment a practical or a very logical one, and for these reasons. Everyone who speaks or writes of naval tactics admits that the large ironclads must be defended by torpedo-boats and other small craft. Surely if that be the case we are led to the conclusion that the small craft are better for fighting purposes than the big craft. If it be essential to defend the big craft by the small ones, surely we must logically be led to the conclusion that small craft are better than big ones for fighting purposes. Let me give an illustration of what I mean. Assuming that there are two fleets of ironclads each defended by torpedo-vessels, if it were possible for one of the Admirals in command to have the power of removing a big ship and replacing it with a small one, clearly he would do so, because he would then have the advantage of his original torpedo-ship, and then of his second torpedo-ship against the ironclad of his adversary, and everyone admits that the torpedo-vessels have the advantage. Of course it will be said at once by naval men that it would be absurd to propose to substitute for ironclads more torpedo-vessels, and that is perfectly true because there are so many occasions upon which guns and big ships are required in our profession; but I ask if the tendency of the progress of naval science is not on that account alone towards decreasing the size of the ship rather than towards increasing it. Instead of increasing it, looking at the illustration I have given that the small craft are after all of the greatest importance in naval actions, which is the great thing we have to consider, does it not show that the tendency of naval progress ought to be towards decreasing the size of the ship? There is just one other point which was alluded to in the lecture, and that is the question of turning our ships. I conceive that that is perhaps one of the most important phases of evolution which must take place in our fleet. It is a very curious circumstance, that in spite of all the progress that has been made in ships, we are still practically turning our vessels by exactly the same method in which vessels were turned

a hundred, or any number of years ago that you like. It is true that with machinery we have improved the method of moving our rudders, but we still have to rely entirely upon the rudder for turning ships. So long as rudders do all that is required there is not the smallest objection to them, but they do not do all that is required, and it is curious we so seldom find that professional men go very much into the subject of the necessity of turning vessels, not in a small space so much, but with very great rapidity. In my humble opinion the power of turning not in a small space, but with very great rapidity, will be the power which in all probability in future will give success to a fleet or to individual ships. No doubt one of the reasons why this has never been developed to any great extent is simply that there is no demand for it except in fighting ships. In the Merchant Service and in the other great steamers there is no demand for turning with rapidity, and consequently it is a subject which does not exercise men's brains. I think, considering the development that is taking place in torpedoes and also in the ram, it is perhaps one of the most important subjects that can be attended to in connection with our fleets. I should like to conclude, if I may be permitted, by expressing my acknowledgments to Admiral Fremantle for the extremely interesting lecture which he has given us, which I feel sure will constitute another step in the interesting and important study of naval tactics.

Captain the Honourable THOMAS BRAND: I am sure Admiral Fremantle will forgive me if I say naturally, on rising to speak on a subject of this sort, that criticism is the first thing, and I shall begin at the beginning, though with many apologies, by criticizing the name of his paper. To my mind it would have been better named "Naval Warfare," because of necessity in his paper he dismisses tactics at what I think was rather short notice. There are two or three points in the paper that I should like to mention. One is the great importance of a good method of lowering the torpedo-boats. I think that possibly boats might be carried further inboard, and moved out on a railway line in the same way as they do the trains in France. In the "Swiftsure" the other day we had our boats carried on a tramway, and if they could have been moved down by these means so as to be immediately under the davits, the work of lowering them would have been very easy. To come to the tactical part of the lecture, Admiral Fremantle objects to the group. I am sorry that I have not sufficient experience to make him reconsider his decision, but I rather like the group, and I should like to point out that in dismissing groups he goes in for pairs. Now to my mind there is very little difference between two and three ships. I prefer the three, but if you want to work your fleet in pairs, and if we intend to have a new organization, why not have the organization in groups? Your ships do not have in the group their bow-fire masked, which is a great point, and I think further that the group system gives more flexibility than any possible formation that I know. Of course if you have groups and call them "pairs" you come to the same thing, but to say that the groups are utterly condemned is, I hope, not quite true.

Captain CYPRIAN BRIDGE: I should like to ask, Sir, with your permission, one question, whether Admiral Fremantle can give us any account of the extent to which the Whitehead torpedo has been used by the French in their operations in China?

Admiral FREMANTLE: I believe the Whitehead torpedo was not used at all.

Captain BRIDGE: Another question I was going to ask was, Whether in the Admiral's ideal fleet, the aggregate of which amounts to something over 100 vessels, the torpedo-boats making up that aggregate, include or are composed of the torpedo-boats carried by the ships themselves? My only reason for asking that question is this: I think it would be a very unfortunate thing if it should go forth to the public, especially with such a distinguished name as that of Admiral Fremantle's attached to it, that each ideal fleet of the future is to be composed of over 100 pendants. In spite of the mendacious—I suppose that word will hardly be regular, so I will call it the insincere—frequency with which we hear it said that no money or no sacrifice would be refused to put the fighting fleet on a proper footing, I think if it once went forth that we wanted for each of our ideal fleets as many as 100 ships (in all probability it would when it got into the newspapers), we should find that any attempt to get a fleet of the proper

strength would not be listened to for a moment. I should be very glad if the Admiral could tell us whether the torpedo-boats in his fleet are composed to a great extent of the boats carried by the ships themselves, so that the dimensions of the fleet would not be extended so greatly as might otherwise be supposed from his statement.

The CHAIRMAN : I think Admiral Fremantle only intended to give the proportion of large and small vessels that he would recommend in an ideal fleet, and not to give what he considered should be the smallest fleet or the largest fleet that should be collected together.

Admiral FREMANTLE : I propose an ideal fleet of twelve ironclads, and I say that suppose you had twelve ironclads I think that you ought to have all these additional small craft. But in my examples I only gave eight ships ; I therefore do not hold to the necessity of having twelve ships ; you may halve the number if you like. I have prepared a calculation as to what I think the expense of such a fleet as I have proposed of twelve ships would be, to which I will allude in my general reply.

Captain HAMMILL : In coming here to-day to listen to the admirable lecture we have just heard from Admiral Fremantle, I must confess my first thoughts were that I did not know what the lecture would be about—I had no idea what “naval tactics” were—I mean in the present day. I cannot conceive how you can build up any satisfactory system of modern naval tactics on what has gone before. If you take an ironclad of the present day with all her fighting machinery, modern appliances, and auxiliaries, and compare her with an old line-of-battle ship, there is nothing in common between them. Therefore, you cannot compare a system of tactics or order of battle suitable for one with a system or order suitable for the other. What we suffer from appears to me to be this : that we have no “school of tactics” whatever in the Navy. I know that some years ago Captain Colomb brought out a very capital war-game, which, I believe, has been widely taken up abroad, by Russia especially. I have read occasionally of naval war-game battles having been fought in that country. For my own part, although I have seen a great deal of what has been going on in the Service the last six or seven years, or since the war-game was invented, I have seen one naval war-game fought, and one only, and that on board the “Vernon,” I think, in 1879. No doubt many others have been fought, perhaps even in my own ship, without my knowing it, but what I mean to convey is this, that as an Officer who has been in the Service and serving I have not seen or heard of a single other war-game being fought than the one above mentioned. The only way, in my opinion, in which we can learn modern tactics is by thoroughly discussing the systems that might be adopted, and by practising them in peace-time, so that we may be prepared to follow some system in time of war. I am not prepared to propose a better system of naval tactics than what Admiral Fremantle advocates, or any system, in fact ; but I think there is ample room for examination and inquiry into the subject.

Sir THOMAS BRASSEY : As Admiral Fremantle referred to a phrase which occurred in a contribution which I made to a magazine, I should like to say a word or two in explanation of the meaning which that expression was intended to convey. The phrase that “torpedo-boats were the arm of the feeble” occurred in a paper in which I endeavoured to show that the Board of Admiralty, which in its ship-building policy was largely influenced by your advice, had made an honest endeavour to develop the strength of the Navy. They may not have gone on as rapidly as we might have wished, but our hope was that we were moving in the right direction. What was the policy of that Board ? I am not going, of course, to enter into that at any length, but the policy of that Board in its earlier years was to give a decided development to the armoured construction of the Navy. The torpedo-boat was not considered by you, Sir, I believe, if I rightly understand your view, to be the arm to which in time of peace, in the circumstances with which we had to deal five years ago, we should direct our principal efforts. In the later years of the Administration with which you were connected, a great effort was made to add to the strength of the Fleet in sea-going torpedo-vessels, and you, Sir, I believe, were of opinion that a sea-keeping torpedo-vessel was more important to the British Navy than a boat whose zone of action was limited to the defence of harbours. That

policy was the policy which you recommended to a Power which claims to be the mistress of the seas. Torpedo-boats designed strictly for harbour defence are, of course, a most important feature in the naval preparations of those Powers which do not attempt to hold a great position on the high seas, but which are looking chiefly to the defence of their coasts. Before sitting down I should like to say just this with reference to the shipbuilding policy of the future: all that I have heard from naval authorities satisfies me that those who have the direction of the expenditure of the nation upon its Navy should endeavour to strengthen that Navy in every class of fighting vessel. Of all the descriptions of fighting-ships—though we can afford to neglect none at the present time—I believe that which it is most important to add to our shipbuilding programme is the sea-keeping torpedo-boat. We have ironclads, we have fast cruisers, we have the larger torpedo-vessel of the “Archer” type represented in considerable numbers in the last shipbuilding programme which was presented to Parliament, and I venture to hope that in the shipbuilding programme which we shall shortly be called upon to consider in Parliament we shall find a large development given to sea-keeping torpedo-boats. When I had the advantage of accompanying Admiral Hornby in the cruise of the Evolutionary Squadron last year on the coast of Ireland, I was very sensible—as anybody must have been who was present—of the inefficiency in point of dimensions of the boats which accompanied that squadron. They were valuable, no doubt, for operations within easy reach of harbours, but they were certainly not sufficiently powerful to contend with the open ocean, and when on a later occasion—a very late occasion—I saw Lord John Hay preparing to go to sea from Malta to the rendezvous at Suda Bay, it certainly seemed to me that if it was recognized as essential that the Fleet should be attended by torpedo-vessels, the three first-class torpedo-boats of a very early type, which were to accompany that fleet, were not of a sea-keeping character, and that it behoved those who are responsible for the administration of the Navy to lose no time in adding to our naval resources a very considerable number of torpedo-vessels, in model very much resembling torpedo-boats which we now have, but considerably larger in the point of dimensions. I hope that those boats will be found occupying an important space in the programme which will very shortly be submitted to Parliament.

Mr. BEAZELEY: If I may be allowed as a visitor and a civil engineer to make one or two remarks on Admiral Fremantle's extremely interesting lecture, I should like to claim the priority of invention of his excellent boat-lowering apparatus for the late Mr. John Wright, Engineer. Mr. Wright was extremely well known in the profession as a civil engineer, and thirty years ago, when I had the advantage of being a pupil of his, he described, at the President's *Conversazione*, in Great George Street, in May, 1856, the model of his boat-lowering apparatus. As one of his pupils, I had the charge of exhibiting it to those who were present, and it was precisely in detail the same thing that Admiral Fremantle has shown us to-day. The davits were curved, and they were hinged down the sides of the ship. It excited a good deal of attention at the *conversazione*, but probably did not go further owing to its having been shown at a purely civil, and not at a naval exhibition. I should like to make some remarks with regard to Admiral Fremantle's description of the operations in the River Min, in August, 1884, against the Chinese Fleet; and without trenching on politics, or on dangerous topics, I may say that although I was not present on the Min at the time, I was resident at the neighbouring port of Amoy, and had been so for several years past in the service of the Chinese Government—not in either of the military services, but in the peaceful occupation of lighting the coast of the southern part of China. I am extremely well acquainted with the River Min, as I have no doubt is the case with many Officers present who have been on the China Station, and I can only say this, that if the Chinese Government had been furnished with a proper torpedo apparatus, especially with the Whitehead torpedo that Admiral Fremantle has so justly praised, not one of those French vessels ought ever to have got down the river again. Anybody acquainted with the Min up to Pagoda Anchorage, where this destruction of Chinese vessels took place, must be aware that with the slightest, the most rudimentary, attempt at torpedo service, every one of those French vessels would have been destroyed. Without entering on dangerous topics I may say, Sir,

that since the massacre at Sinope, I cannot remember anything more horrible than that affair was. Those who have been on the China Station must know what those fifteen vessels were that were sunk and destroyed. They were merely small wooden arsenal gunboats, with one exception, which was a training ship. By a strange irony of fate they were built at the Foochow Arsenal under the superintendence and entirely under the direction of French authorities. These fifteen small helpless wooden vessels and their unfortunate crews were sunk by the powerful French iron-clad fleet; and this naval victory, which was made so much of in the French papers, was simply a cowardly and most brutal massacre.

Captain CURTIS: With regard to the lowering of boats at sea, it seems to me that the great danger arises from the ship's rolling and thus there is fear of staving the boat. The arrangement suggested by Admiral Fremantle seems to me to be very good, with the exception that you want a spur to keep the boat clear of the ship. With respect to ironclads, I look upon them as bearing the same relation to the Navy as siege-guns do to the Army. No one would think of moving siege-guns without some protection or support, and therefore I think it is quite right that ironclads should be supported by torpedo-boats in blockading or sealing an enemy's ports and otherwise. Looking at our distant Colonies, it becomes very essential that we should be able to move these floating fortresses to far-distant lands thousands of miles off. Our present torpedo-boats and small cruisers, also ocean cruisers, are not vessels adapted for sealing ports or protecting arsenals and commercial ports. Then with respect to the nets: Admiral Fremantle says the *dépôt* ships will supply nets to the Fleet. I mentioned the other day when we were discussing Mr. Nordenfelt's lecture that I thought, in all probability, vessels carrying spars and so forth would accompany the Fleet, and working parties would lay out the booms and gear in order to protect the blockading fleet. Moreover, the nets would act as a breakwater. A net off Cowes in the Isle of Wight did act and break the sea, some few years ago. Moreover, with respect to steering gear, the efficiency of manœuvring the Fleet will in a very great measure depend upon the efficiency of the manœuvring and steering power of ships.¹ Without mentioning the names of ships, "if it is true," as we have read of late, that some of them are very defective in steering, I think it would be a very good thing if a Committee of naval experts were appointed to report on the subject.

Colonel HOPE, U.C.: As apparently there are no other naval Officers inclined to take part in the discussion, I beg to say a few words, though with great diffidence, in the presence of so many very distinguished sailors, being myself one of those helpless persons known in the Navy as "soldier Officers." I have listened with great pleasure to the Admiral's remarks as to the real, proper, sober value of torpedo-boats, and I think that anyone who has seen something of warfare must come pretty much to the same conclusion,—that the risk to human life on board a torpedo-boat in broad daylight is so terrible that there will be the very greatest possible difficulty in getting crews, except, perhaps, on the first occasion. I have also listened with great pleasure to the few isolated remarks which he made with regard to guns, of which he appears to entertain a very high opinion, and I only rise for the purpose of telling him and those present that I hope to have a gun ready for public trial about the 1st May; I will announce it in the "Times," and I shall be very happy to see anyone who wishes to come to the trial. It will be the first of six guns that I am making for a foreign Government. These guns will have a velocity of 4,500 feet per second; and that not with a light shot, but with a shot of double the ordinary length and weight. That evidently introduces a new feature into naval tactics. The first gun, which will be a small one—I have an order for four of them, and two large ones—is a 2½-inch gun, throwing a 12-lb. shell with 19 lbs. of powder; the two larger guns are 5-inch guns, throwing a 95-lb. shell with 151 lbs. of powder. The 2½-inch 12-pr. will be able to sink a torpedo-boat almost, if not quite, on the horizon line, and the penetration at 1,000 yards will be about

¹ It would appear that some ships are very deficient in steering, and are not only a source of danger to themselves, but to others accompanying them.—J. D. C.

13 inches of standard wrought iron. The 5-inch gun, weighing about $8\frac{3}{4}$ tons, will have the same penetration as the gun which has been so long hatching, but which is not yet completed, at Woolwich, which used to be called a 63-ton gun, then 64, and now 68-ton.

Captain P. H. COLOMB, R.N. : I did not intend to have risen, as the hour is rather late, but I do not think it would be quite right for me not to express the feelings with which I have listened to my old friend Admiral Fremantle's paper. I have been very much struck with its moderation, and with the way in which the Admiral has balanced point against point, so that no one amongst us can say that he has "run away with an idea." And he has, I may say, completely filled his paper with thoughts which are of a momentous character. I do not propose to go into criticism upon the paper, but merely to say this, that with by far the greater part of what he has said I feel myself in complete concurrence. I must, however, differ from him on one point, which was referred to in the form of a question by Captain Bridge, that is, as to the proportionate numbers of small craft which would be necessary to accompany a fleet of ironclads. My impression is that the numbers, when you come to examine them more closely, would not be so large. I ought to say also, in reply to a remark of Captain Bethell's, that I am not sure at all that the general feeling in the Navy has been that it is necessary to have small vessels for the protection of ironclads. I rather think that the feeling of the Navy has been that the object of the small vessels is to make the attack—not to protect their friends but to damage their enemies. I think it is held generally—I am not going to say whether it is right or wrong—but I think it is held generally that given modern ironclads with a sufficiency of small guns, of quick-firing and machine-guns, and given nets or other suitable protection from torpedo-boats and vessels, and they are considered in the Navy generally to be well able to take care of themselves. I quite agree with what fell from Sir Thomas Brassey in reference to the policy of building these sea-keeping torpedo-vessels, and I have no doubt whatever that that policy will be continued. A remark was made—I think by Captain Hammill—to the effect that we could not revert satisfactorily to the tactics of a former age in view of preparing the tactics of the future. I do not quite agree with that. I think that you must look back to the tactics of a former age as the only foundation on which you can prepare your future tactics. Of course you may use history or you may misuse it, but I think if you study carefully the tactics of a past age, they will guide you to the fundamental principles which must govern the tactics of a future age. I think the lecturer has brought out that point, following up with greater elaboration the idea with which he credited me for having started some years ago, and that is the doubling upon a ship. In old days the attempt was to double by placing two ships in such a position as to present a greater force upon one ship. That has passed away now, because fleets will fight at considerable speed. The doubling now is that two or more ships should pass one ship and give her broadside after broadside, or torpedo after torpedo, and thus double upon her in succession, and not in position. Now, if you followed the historical method, and attempted to place your ships now in the form of doubling in position, you would be wrong, but the idea of doubling is simply changed from the old tactics and applied to the new, and in that way I think you can always use the history of the past to guide your steps in the future.

Admiral FREMANTLE, in reply, said: Captain Bethell in his remarks said that the tendency of the future would naturally be to decrease the size of the ironclads. I think if he refers to a lecture which was delivered here not very long ago by Sir Edward Reed, he will find that Lieutenant Tupper gave a description of what he thought would be a very proper ship. He enumerated all the things which were to be put into her, and then he said that the ship must not be too large. Sir Edward Reed took him up directly, and said, "This is all very fine; it is exactly what the naval Officers are always asking for. They want this and that; they want a fast ship; they want a ship to carry big guns; they want a ship fitted in every possible way, and then they say, 'Don't make her too large.'" I agree that we do not want a ship to be too large, but then if we come to look at it from the naval architect's point of view I think we shall find it extremely hard to point out exactly where we

should wish the line to be drawn, and what we are going to give up. If we are satisfied to give up speed, like Admiral Elliot, we may come to a point which we may think satisfactory. I think it is not satisfactory to sacrifice speed. But we must give up something. It is only a question of detail, but I must say that my sympathies are rather with the naval architect in that matter. Captain Brand made a very fair criticism upon the name of the lecture. I do not think we do know quite what naval tactics are, and I am bound to confess that perhaps it would have been better to have called my lecture "Naval Warfare." My excuse is that I was asked whether I would give a lecture, and whether it should be on the 19th of February, and I thought "Naval Tactics" covered the ground pretty fully. Certainly I meant to deal generally with the questions of the day—the question of torpedo-boats especially; but I think "Naval Warfare" would have been a much better name. As regards groups, it is a very difficult subject, and a very technical subject, and one into which I do not care to enter at this moment; but I think when Captain Brand spoke in favour of groups, he said he meant generally a group of two. That is a very different matter. The group of three is a thing I object to, as not being usually practical or efficient, though it may appear to be clever. What I call "a trap for the unwary" is a group in the form of a scalene triangle of very curious shape. The ships are to keep their position in a very curious way, and everybody knows that you have got to a very funny state of affairs in the Signal Book through that sort of group. You tell them that when they are to alter course in succession, they are to alter course together. Altering course in succession we understand it, is follow-my-leader: altering course together is right or left turn at once. Now, when you have come to the farce of telling these ships when they are in a group that because they are in a group when they are told to alter course in succession they are to alter course together, I think that it shows the difficulty that we have been driven to. I think Captain Colomb had a great deal to do with the Signal Book, and we may be sure that he felt driven by the logic of facts to put ships into that position, and if so I do not consider that it is very practical. But I will reconsider my views if any Admiral will tell me that it is practical. I agree that there are advantages in a group, if two ships are to be called a group, but I think it is clearer to call them a subdivision, and tell subdivisions to act independently, instead of talking some shibboleth about groups, and saying groups are to act independently. Captain Bridge asked a very proper question about the torpedo-boat, as to whether in the 100 sail which I mentioned the boats carried by the ships themselves were included. Certainly not. The fifty first-class torpedo-boats that I put down are of course not carried on the ships. I consider that the amount of small craft that would be required is very considerable, and my ideal fleet I calculated would cost a little over thirteen millions of money. Perhaps that is a great deal too much; possibly we should have only six ironclads in the fleet, and in that case the cost would be only six millions. I do not wish that to be taken at all as my idea of what necessarily would be a fleet, but if you assume that you are to have twelve ironclads I am rather inclined to assume that you ought to have all those small craft to protect them, and to assist them to counteract the enemy's small craft. I may perhaps point out that in 1883 our import and export trade amounted to 731 millions, and that is a very large amount to protect. In 1884, although it had somewhat decreased, it still was 685 millions. Captain Hammill's question with reference to comparing future naval tactics with the tactics of a past day has been so well answered by Captain Colomb in so much better language than I can command, that I really have nothing to add except to say that I am much obliged to Captain Colomb for having put it so clearly and so eloquently. As regards the naval war game, I quite agree with Captain Hammill. I think I have fought two games, but that is about all. I bought the block, and intended to go at it. In one ship we had, as I say, two or three games. I am very sorry that it has not been more adopted in the Navy. It certainly was extremely useful. It gave you certain rules which were of great service, and it also afforded some general information as to the tactics of a gun and torpedo action between a couple of ships. I quite understand what Sir Thomas Brassey mentioned about the arm of the feeble. He was talking about torpedo-boats for harbour defence,

but there is a general idea that by some invention or other you will be able to have cheap methods of warfare, which I object to. Mr. Nordenfelt, for instance, says that his submarine boat is very cheap. He says, "I can build this for so many thousand pounds, and I can blow you up a ship which cost a hundred times as much;" but when you come to multiply these torpedo or diving-boats, you find that they are no longer the arm of the feeble, and when you come to have fifty of them, you will see that they cost a good deal. I have shown that we have 130 torpedo-boats, so that they are already in existence in large force, and I find that the fifty torpedo-boats in my ideal fleet would cost about 750,000*l*. As an instance of what I mean, M. Gabriel Charmes seems to have talked a good deal about the easy way in which he could destroy the British Navy, and amongst other things he was going to have some magnificent cruisers which would go about 25 knots, and which he put down as costing "not less than 80,000*l*." Now our 19-knot American liners, the "Umbria" and "Etruria," which nearly approach M. Charmes' ideal, cost 325,000*l*. each! Of course this shows how very easy it is to talk about a very cheap thing until you come to order it; but when you come to order it and want to get it, you find you cannot do it quite so cheaply. I think it is a satisfaction to us to know that we have the money to a certain extent to do these things, but at all events it is very easy to talk about having cheap torpedo-boats. That was the reason why I mentioned the question of the arm of the feeble, because I think it is wrong to speak of it as a cheap thing to have torpedo-boats. I am afraid it is not cheap, and the fact is that all these inventions cost money. With regard to what was said about the River Min operations, I have nothing to say as to the illegality of those operations or their inhumanity, or any questions of that nature, but I must repeat that, having read the French report, I thoroughly believe they were carried out skilfully, and that we have something to learn from them. I think it right to mention, as regards the torpedoes which they used, that they were used from two steel torpedo-boats, which simply ran out and deposited their torpedoes under the Chinese sterns before the Chinese fired a shot. Of course that does not prove very much in favour of the torpedoes. I think they had some Whiteheads in one of the ships afterwards, but they never certainly fired a shot. Sir Cooper Key says they had none. With regard to the boat-lowering apparatus which Captain Curtis criticized, I am much obliged to him for his criticism, but I may say that this model is not complete. The spur is very much what we have for hauling out the davits in the paddle-box boat. I do not put it forward as an invention, but I wish that something could be done for getting our torpedo-boats into the water, and I am sure that anyone who has had experience in getting them out of a turret-ship with one derrick, gingering them in and out inside the rigging and outside the rigging, stopping the derrick, and hoisting the boats, and so on, will understand that it is a perfectly unpractical plan of attempting to get your boats out at sea even in fine weather. With regard to the speed of the ships, I should say they should go about 12 knots. I am very glad that Colonel Hope approves of the gun. Of course Colonel Hope is a great authority on the gun question. My own impression is that the last word has certainly not been said on the part of the gun, and that one reason why the torpedo-boat has had so much in its favour is that it is ahead of the gun to a certain extent, as I have pointed out in the lecture. I am very much obliged to Captain Colomb for the extremely complimentary way in which he was good enough to speak of my lecture. I am sure he will appreciate how difficult it is to deal with a subject of this sort, which is a very large subject, and how everybody will say, "Why, he has not touched upon that particular subject which is of great importance." I venture to think that I tried to take the most important point, and to deal principally with that. If therefore I have failed in dealing with certain parts of my subject, I must ask you to excuse me, but really what I did intend to do was to deal with the question of torpedo-boats and torpedo-catchers. I beg to thank all the speakers for the exceedingly kind way in which they have spoken of the lecture generally, and I only wish it had been a better one.

The CHAIRMAN: I have now the pleasing duty of asking you to allow me to

return your thanks to Admiral Fremantle for his interesting lecture on very important subjects. I am not here either to air my own opinions, or to discuss the many questions that have been brought before us. I am simply here as your spokesman, and I am glad that I cannot be expected to go fully into all the questions that have been raised to-day. Captain Bethell made some interesting remarks, with which I agree, that it is for us to consider whether the days of ironclads are passing away. I do not say that such a change is imminent, or that in my time we shall see it; but I am satisfied that we shall have to look forward to it before very long. It is highly improbable that torpedo-boats will take the place of ironclads. Captain Bethell remarked that if two fleets of ironclads are engaged, and that each has a squadron of torpedo-boats protecting them, you might gain an advantage by sending your ironclads away, but replacing them by another squadron of torpedo-boats, you would be very much stronger. To carry out the same principle you might say that you would be still stronger if you had no ships at all, because that would be the next step to take; having sent your ships away, send your torpedo-boats away, and then you cannot be hurt. But without squadrons and large numbers of seagoing ships, how are we to protect our Colonies and commerce? We must have a vast number of large ships and small ships; torpedo-boats will take their place as auxiliaries. I am glad to learn, from the remarks Admiral Fremantle has made, that he does not look forward to our naval power being threatened by the introduction of torpedo-boats. What we have to do is to look round us and prepare to meet the attacks of torpedo-boats, and be satisfied that whatever number of light vessels or torpedo-boats other nations build for themselves, we must treble or quadruple it. No maritime nation in the world has such power to turn out small vessels, whether torpedo-boats, fast cruisers, or protected cruisers, so rapidly as we can, if we choose to see the necessity for it, which I believe now exists. It is a vague theoretical idea entertained by some people that our naval power is threatened by the introduction of torpedo-boats. What we have to do is to meet one by three, and that is what we must certainly do. Captain Colomb has somewhat forestalled me in the remarks I should have made on this admirable lecture in saying that Admiral Fremantle has put every point forward in such a moderate way, he has not put forward prominently any particular fad or pet whim, which is usually our weakness. I think the lecture is both interesting and instructive, showing an intimate knowledge of what other Powers are doing. Every question has been put reasonably before us. I do not think that Captain Colomb, in answering Captain Hammill's remarks, brought out quite clearly what Admiral Fremantle intended to say. No doubt the study of naval warfare of former days teaches us the principles on which naval tactics should be invariably founded, but only the principles. As regards naval tactics of the future, I think they are "all in the air," but those elementary principles, founded on courage, presence of mind, rapid decision as to the best means of bringing a superior force quickly to bear on an inferior force—those principles remain to all eternity; but they do not include the science of naval tactics. With Captain Hammill I looked forward with some anxiety to see what direction a paper headed "Naval Tactics" would take, because such a subject is open to a discussion of the wildest character with our little experience of the engagement of hostile steam fleets. I think Admiral Fremantle deserves our applause for having produced a paper which gives us so much room for thought. I might, without touching on tactics, say one word about groups. I think both Captain Brand and Admiral Fremantle hardly referred to the real importance of the use of groups. I look upon their principal advantage as this. Call them pelotons or subdivisions, if you like, but I think an Admiral should organize his fleet so as to be able to form them into subdivisions of three ships. He has then a power of selecting Officers for the command of each group or small squadron or subdivision, and knowing that when the original formation of the fleet is broken up, which it certainly will be in a general action, he has in each subdivision three ships that will stick together under a good Officer, and that that man will take care when opportunity offers, as Nelson did at St. Vincent, to bring his little subdivision to bear where it is most wanted, only, of course, when he loses touch of his Admiral. I think that is the advantage of it. But I say

also that I do not think it is a comfortable thing, manœuvring in groups, formed, as is usual, in a scalene triangle. The advantage of that formation is for fighting only, and that by a touch of your helm you can bring these three ships in line ahead, and then again by a touch of the helm you can re-form them into groups. You can thus manœuvre those ships in the simple formation of subdivisions in line ahead, and when you are going to engage throw them into groups instantly, which will clear your broadside and bow fire. But I would not manœuvre my groups, because I believe it will be found that manœuvring in a scalene triangle with inexperienced Captains, who have not been accustomed to work together, will lead to confusion. At this late hour I will simply ask you to allow me to tender Admiral Fremantle your thanks for his admirable and interesting paper.

Friday, February 26, 1886.

GENERAL THE RIGHT HONOURABLE VISCOUNT WOLSELEY, K.T.,
G.C.B., G.C.M.G., &c., &c., in the Chair.

INFANTRY FIRE TACTICS: ATTACK FORMATIONS AND SQUARES.

By Lieut.-General Sir GERALD GRAHAM, U.C., G.C.M.G., K.C.B.

OUT of respect for the force I had the honour to command in the recent Suakin Campaign, I propose to take square formations first, as applied to Soudan warfare; a subject that was ably though not exhaustively discussed in a lecture delivered in this theatre in June last year, when I could not attend.¹

The real reason for our adopting square formations was the dense impenetrable² character of the belts of bush in the desert which paralyzed effective cavalry action, while allowing the fearless active Arabs, who move with all the rapidity of cavalry, to approach unseen.

According to the best authorities squares are only to be used when you cannot protect your flanks and rear by any other formation against an enemy who employs shock-tactics; therefore, in these days of long-ranging arms of precision, squares should rarely be used against cavalry, as that arm requires open country to charge over, so that the best defence for infantry would be as complete a development of fire as possible. Thick bush of course neutralizes the advantage of long-range aimed fire, and with a rapid daring enemy like the Soudanese, compels the troops to maintain a formation which will always protect their flanks and rear. The objection to having separate bodies in échelon, either in line or square, in bush or broken ground, where the enemy can get in between, is that the separated portions of the troops are liable to fire into one another. This actually happened at Tamai in March, 1884, when the two brigades were in separate formations, but happily without serious results.

At the meeting I have referred to in June last, the objections to squares, as a fighting formation, were well stated and will be heartily endorsed by all who have had anything to do with them. Nor must it be supposed that in our fights near Suakin we were slavishly bound to the square as a fighting formation. The necessity for protecting our large convoys obliged us to employ it on the march

¹ *Vide* the Journal, No. CXXXI, page 887, *et seq.*

² The word "almost" was inadvertently admitted.

through the bush. Nevertheless, as the lecturer fairly stated, the battle of El Teb, in 1884, was fought in two lines; and I can add that, in the following battle of Tamai, the second brigade was, after its retirement, brought up in line to recover the naval guns, one battalion being in open column on the left, and the right flank being supported by the first brigade in square. Again at Hasheen on the 20th of March, 1885, the Dihilbat Hill, held by the enemy, was stormed by the Berkshire in attack formation supported by the Royal Marines; and, at Tamai, on the following 1st of April, the advanced brigade had one battalion deployed in line, with a battalion on either flank in column. The heights were afterwards crowned in line, and it was not our fault that there was so little fighting on that occasion. On our march out through the bush we had not less than 340 horses, 740 mules, and 1,670 camels to take care of, besides guns, ambulance wagons, carts, stretcher detachments with numerous native followers, drivers, &c. If anyone can inform me how such a mass of transport and non-combatant followers could have been protected in a march through the bush in presence of an enemy who had repeatedly proved themselves capable of charging against any odds and of doing immense injury to the transport, otherwise than by placing troops all round them, I shall feel much obliged.

A critic of the square formation in "Blackwood's Magazine" of May, 1884, makes a most disparaging comparison between our performance at Tamai, in March, 1884, and that of the troops under Sir Charles Napier at Meeanee, in February, 1843.

That great soldier certainly did wonders with his small force, but notwithstanding the marvellous disproportion of numbers, I venture to assert that Sir Charles Napier had not nearly so formidable an enemy to deal with at Meeanee as we had at Tamai.

The Beloochees, estimated as 36,000 strong with 18 guns, occupied the bed of the Fullaillee River along a front of 1,200 yards, the high bank serving them as a rampart. Finding a flank attack impossible, Sir Charles Napier (leaving 400 men as a baggage guard) boldly attacked this position in front with about 2,000 men (of whom only 500 were Europeans) and 12 guns. His formation for attack was a very bold one, as he had no reserve (unless the baggage guard can be considered a reserve), but his advance in échelon of battalion lines, with the European troops leading, was the best possible disposition of his force. He was advancing against an enemy in position armed with matchlocks and having 18 guns, so that line formation was of course that in which he would suffer least loss, while to make the most of his small force he wanted as great a development of fire as possible. Yet it is evident from what took place after the battle that Sir Charles Napier would not have adopted this formation had not both his flanks been protected by the high walls of Shikargahs,¹ and by ground impassable for cavalry. The Shikargah on his right flank had a gap which he closed with a company of the 22nd, who defeated an attempt at a counterstroke by the Beloochees. With this exception the Ameer's

¹ Shikargah, a walled-in hunting ground.—Ed. .

forces seem to have had no idea of advancing beyond the river bank, behind which they crowded and were shot down until finally dispersed by a charge of cavalry. In concluding his stirring account of this brilliant victory, Sir William Napier writes:—

“All were now in retreat, but so doggedly did they move and seemed so inclined to renew the conflict on the level ground, where the British flanks were unprotected, that the General (Sir Charles Napier) unwilling to provoke a second trial, recalled his cavalry and formed a large square, placing his baggage and followers in the centre.” Sir Charles Napier was too good a soldier to have advanced in line with his flanks unprotected or to despise the square as a defensive formation, even against a beaten enemy. As regards the actual fighting at Meeanee the best and most unimpeachable testimony is that of General M'Murdo, then a subaltern of the 22nd Regiment, a cool and observant eye-witness, and in that very interesting memoir of Sir Charles Napier by Mr. William Napier Bruce—General M'Murdo writes as follows:—

“The behaviour of our men (22nd) when they charged to the edge of the bank of the Fullaillee surprised me exceedingly; but as the fighting went on, I saw they had judged rightly, and their example was implicitly followed by the native regiment on their left. The line recoiled some six or eight paces, and then remained deaf to all orders and entreaties to renew the charge; the men advancing only to deliver their fire into the thick masses of the enemy in the river bed, and returning to load; this mode of fighting was continued for the greater part of one hour. The behaviour of the Beloochees was equally strange and unexpected; but perhaps equally natural under the circumstances. Their fire, beaten down in volume by a rolling musketry, was only sustained in a desultory manner. They could not make any impression upon our line, beyond forcing it back a few paces. They could not retreat, because they were pressed upon from behind by the masses of which they formed the front rank. Driven desperate by the unceasing musketry, the masses frequently charged with sword and shield over the bank; but as these rushes were not made in concert along their line, our men were able to lap round their flanks, and hurl them back over the edge.”

General M'Murdo also records seeing in the midst of the action about 10 per cent. of the men in the fighting line engaged constantly with the locks of their muskets, either in wiping moisture from the pan, or in chipping their blunted flints; and states “I saw some even change them (the flints) for new ones . . . the men did not fall out to the rear, as on parade, but stood their ground in line with their bayonet points to the enemy.” To enable them to do this so leisurely the enemy must have left them tolerably unmolested. At all events their mode of fighting must have been very different to that of the Arabs who made such desperate charges on our squares at Tamai.

Sir Charles Napier's attack on the Ameer's forces at Meeanee, despite their numbers, was at once prudent and magnificently audacious, as, had he delayed it, their strength and confidence would have greatly increased. Nor could anything have been finer than the leading and conduct of his troops. But, in reply to the Blackwood reviewer, I assert that it is most unfair to our soldiers who fought so gallantly at Tamai to compare these half-hearted followers of the Ameers with the desperate fanatics of the Mahdi, whose great desire

was to get killed after slaying an enemy ; and to argue that because échelon formation was effective against Beloochees in the plains of Scinde, it should have been employed against the Hadendowas in the dense bush of the Soudan desert.

But we must be prepared for other enemies than the brave Soudanese, for an enemy armed like ourselves and trained in the school of modern warfare.

The subjects of fire tactics and attack formations (especially the latter) have often been discussed in this Institution, but they can never be worn out, and always present new features as we bring fresh experience to bear upon them.

In the following observations, I trust I shall be considered as rather desirous of eliciting opinions from Officers of greater experience and knowledge than I possess, and from others who have thought and read about what to us all are subjects of high importance and interest, than as attempting to lay down any theory of my own. indeed, I may commence by stating that I have nothing new to bring forward about fire tactics and attack formations, nothing that will not be familiar to those who have studied the subject.

As we all know, our army exists under very different conditions to those which apply to the vast forces of the Continental Powers. Ours is a volunteer army, service in which should be made attractive, so that the training must not be too severe.¹ It is also an army that has to serve in all parts of the world and to fight against all manner of enemies, so that there is much greater difficulty in carrying out a complete course and system of training than in armies which are kept at home, and only engage in great wars.

On the other hand, we may derive consolation in calling to mind the material out of which we have to form an army, by remembering, in proposing a system of training for our troops, that our soldiers still possess the same qualities of courage, coolness, and self-reliance which enabled them at the Alma, as before in the Peninsula, to meet and repulse in line the massive columns of their enemies.

"It is essential that it should be clearly understood," wrote Home, in 1873, "that the British army with its historic training, and traditions of advancing and fighting never more than two deep, possesses qualifications for modern fighting that the army of no other nation in the world does."

But an army must beware of counting too much on past glories. No troops ever had a more glorious history of victory gained against great odds than the Prussian armies that were crushed on the same day at Jena and Auerstadt, and yet they were of the same stuff and trained in the same school as those who had won the battle of Rossbach against the same enemy. The collapse of the Prussian military power before that of France at the beginning of the century is indeed one of the marvels of history. It seems scarcely credible that the magnificent army which the Great Frederick led, in 1778, to the second invasion of Bohemia should, only fourteen years later,

¹ "The Prussian recruits work like niggers."—BARON STOFFEL.

have to retire in disorder before the raw French levies at Valmy; and that another fourteen years should witness that crowning disaster, within sight of Rossbach, which laid the Prussian Monarchy helpless at the feet of Napoleon. It was in the stern school of disaster and suffering that the foundation was laid of Prussia's greatness, when Stein and Scharnhorst patiently laboured and bided their time. The army of Prussia is a noble monument of a people's patriotism wisely directed, steadily and unremittingly worked at, in prosperity as in adversity.

The present leaders of the German Army are wiser than those who succeeded the Great Frederick, and are not satisfied to rest on their laurels, as is evident by their ceaseless, thoughtful, vigilance in correcting defects and adopting improvements, so as to maintain that great Army in the highest state of efficiency. It is for us to recognize to the full the teaching conveyed by the past history of our own and other armies, and not to assume that it is less incumbent on us than on our neighbours to train our soldiers to meet the requirements of modern warfare. We, happily, have not experienced the disaster—the shame and agony—of seeing our homes invaded and laid waste by a conqueror, or we, too, might take up military reforms in earnest, as the Prussians did. As it is, military reformers, especially if belonging to the Service, are looked on with suspicion as probably only wanting to improve their own position, and as being regardless of spending the people's money. Whatever the cause may be, we certainly are not prompt or earnest in modelling our Army in accordance with the progressive changes in warfare. A German writer,¹ in enumerating the various changes other nations immediately adopted in their Army organization and tactics in consequence of the events of 1870 and 1871, observes: "Only England persisted in her old Army system, relying on her geographical position."

It is too true that we as a nation do rely overmuch on having water all round us and on our splendid naval victories of former days, so that we are apt to treat as mere alarmists those who point out that we may one day have to fight for our national existence upon our own soil. Independently, however, of all possible chance of invasion, the time may come when we shall have to measure our strength with that of one of the great Continental Powers, and it behoves us to consider whether the force we shall have available will be at its highest attainable efficiency, and if not, what steps should be taken to reach that point.

One great lesson for us to learn from the Franco-German War is the transcendent importance of the individual training of the soldier under his Officers, with consequent fire-discipline and knowledge of the tactical use of his arm. The German infantry had a weapon inferior to that of the French, and at the commencement of the war their tactical formations were very faulty, but everything was redeemed by the fine spirit and discipline of Officers and men, which made them always push forward to the sound of the cannon, and which enabled them to reserve the greatest energy of their fire for the decisive phase of the action.

¹ Colonel von Boguslawski.

Under the old Prussian system of Frederick the Great, on which our close order drill is still based, the men were mere component parts of a machine trained to work under the hands of their commander with perfect order and precision, their courage and training being shown by moving under fire as if on parade.

A fighting unit is now no longer to be considered as a machine but rather as an organism, each atom of which has its individual life and energy, and men must now be trained to a higher standard of discipline and self-reliance than formerly.

When fighting in extended order, groups will frequently be deprived of their leaders, and it will be easier for a man to evade a difficult or dangerous duty when not under the eye of his Officer than when forming one of a close body. Special organization and trained self-restraint is required to give a soldier good fire-discipline in the heat of action, and trained intelligence to enable him to take advantage of the ground. In the German Service this training is carried on in companies and battalions under a system that leaves great independence of judgment and individual initiative to the Officers. There is a very interesting report by Baron Kaulbars, of the Prussian Service, on the German Army in 1876, translated by Colonel Sir Lumley Graham, in No. CIX of the Journal of this Institution. It is too long to be quoted here, but in it it is stated that the commanders of companies have the entire responsibility for the training of their men, the only check upon them being occasional inspections. "The commander of the battalion is not allowed to interfere with the instruction of the companies. Later on he will in his turn take his battalion in hand, and will then become entirely responsible for its tactical instruction." Such a system is well calculated to make Officers and men take a strong interest in their work; and avoid stagnation over routine duties by promoting a healthy emulation among Officers of all grades.

As regards the training required for the men, a very distinguished Officer of the German Army writes as follows:—

"The individual action of skirmishers in the firing-line will be on all occasions the most important part of the infantry soldier's fighting, and the army which learns best how to train the individual foot soldier to make the most of his firearms, and at the same time to act upon the signs, the orders, and the example of his leaders, will gain a decided preponderance in war. For of what use is action, however vigorous, unless directed with good judgment upon the decisive point? In this consists the difficulty of military training. The men must be accustomed, through fighting in extended order, to obey the commands of their Officers and to maintain perfect discipline. This combination of discipline with individual initiative was the great secret of the superiority of our infantry in 1870-71, and will surely give the preponderance to any infantry over another inferior to it in that respect. This fact has been recognized by our authorities and is the motive for all the alterations to be found in the Infantry Field Exercise Book of 1876. The alterations thus made prove that those at the head of our Army gathered from the experience of the last war, successful as it was, the necessity for tactical improvements, thereby admitting the previous existence of imperfections. This admission entails no shame on those who made it, but is on the contrary highly creditable to them."¹

¹ Prince Hohenlohe on Infantry, translated by Colonel Sir Lumley Graham. "Journal Royal United Service Institution," No. CXXX, page 745, *et seq.*

To this is appended a footnote by the translator, with which we must all fully concur:—"The conduct first of the Prussian Army, afterwards of the German Army, in constantly seeking to surpass itself, is one of the most noteworthy points in the military history of the nation. Most armies after such unparalleled successes would have gone to sleep and rested on their laurels."

Speaking at this Institution in 1884, Lord Wolseley said:—

"I cannot help thinking that nearly all the armies of the world, certainly our own, have always reversed the order in which drill ought to be taught. Our notions as to what a battle ought to be seem to have come down to us from pre-historic times almost. We then apparently set to work to create a system of drill to meet the circumstances and exigencies of this imaginary battle. My view of drill would be exactly the reverse of that process. I would first of all read the books written by others who have great experience of what has taken place, and what does take place, in every action. I would find out exactly what it is—what an action is—from the very first moment a shot is fired until the position on either side is stormed and taken. I would find that out; find out what the duties of a private soldier in action really are, and having thoroughly arrived at that conclusion, then work back from that to the goose step."

Acting on the principle thus clearly stated, is it not time we should recognize that the essential point in training our young soldiers is, that they should learn how to fight in extended order, and that we should therefore establish a system of drill, calculated to enable our Officers to turn men out fit for active service within the shortest possible period? At present we devote too much time to mere parade movements in close formation.

"The British infantry," writes one of our critics, "must rise to a higher conception of its functions and duties if it would not fall behind that of all Europe. The recruit must indeed be first trained in the barrack square to discipline of limb and mind, but that once done, he must be developed into the best possible fighting man. Drill is all very well as the alphabet of his work, but too much of it, unrelieved by higher training, kills that individuality which is above all things necessary to the fighting of to-day."

It is more true now than it was when Napoleon I wrote, "Fire is everything; the rest is but of small account." The instruction of the soldier in the proper use of his weapon under fire-discipline is the all-important part of his training. By looking at the conditions under which our soldiers will have to fight, we may endeavour to work back to the fire-training required on the principle sketched out by Lord Wolseley as regards drill.

We must then begin by considering the state of affairs when the fighting line of an attacking force has advanced to within 400 yards of the enemy's position and is hotly engaged. We have all read of, and some of us know from experience, the feeling of wild excitement that prevails among soldiers when in action at close quarters, when each man seems only to want to empty his cartridge pouch as rapidly as possible. This is often the result of uncontrolled fighting energy which, properly disciplined, leads to victory, but which without such restraint may bring about disaster. This is then the point we have to train up to, the ideal we have to try and reach; to evolve order out of disorder, and maintain control over the men in the most critical

moment of the battle, the moment when control is most needed, for that side which shows steadiest discipline and determination when it comes to close quarters, must win.

In a battle now-a-days fire-discipline must come first and foremost in importance. If men will not listen to their leader's orders to cease firing, they will certainly not listen to any other orders, and all power of direction will be taken out of the commander's hands. It becomes then a mere matter of impulse with the soldier, whether he rushes to the front under the spur of a brave enthusiasm, or to the rear under the influence of blind panic.

These are the words of General Skobelev, and are applicable to troops employed against either a civilized or an uncivilized enemy :— "I cannot urge too strongly on commanders to have the fire of their men under control. . . He (each commander) must have his troops completely in hand at the critical moment of action, and they must be in his hands an instrument which serves him to impress with a supreme energy his thoughts, will, and feelings."

There are some admirable remarks on fire-discipline in the paper from which I have already quoted by Prince Hohenlohe, who writes with soldierly frankness, and although an artillery Officer, his remarks on infantry are well worth our attention.

"I have often remarked," he writes, "how much fire-discipline is weakened when the element of danger makes itself sensible. Troops imperfectly trained do not aim, do not even fire, they only let off their pieces. Even before I ever saw a shot fired, I was told by men experienced in war, that infantry soldiers must have attained to a certain degree of proficiency if they could be got to put their rifles to the shoulder when firing. At the battle of Königgrätz I had a very near view of troops (Austrian) keeping up a wild fire with their rifles pointed straight up in the air. . . . How much more trouble is required before we can train the infantry soldier to pay attention to orders and signals during all the excitement of battle, to observe the object to be aimed at, the sight and mode of firing to be used, and to cease firing when the specified number of rounds has been expended? You are asking a great deal of a man who is being shot at when you tell him to cease firing for a while When firing once begins, men get easily out of hand, unless restrained by an iron discipline. . . . It is but human nature that a soldier should derive some comfort from the noise made by his own gun when it goes off. The more raw the soldier the more will he be inclined to 'shoot himself into courage.' During the first campaign in which I took part I was present at a little outpost skirmish, after which the Lieutenant inspected the men's pouches. The older hands had only fired from three to five rounds each, while every recruit had got rid of over twenty."¹

Fire-discipline requires special training and much practice in peace time. It will not do to assume that because a man moves with faultless precision on parade, or makes good practice at a fixed target, that he will be able to control himself so as to expend his cartridges with judgment in the excitement of action, or listen coolly to orders from his Officer under conditions entirely unlike those of his ordinary musketry practice. The conditions could indeed be scarcely more dissimilar than those of ordinary target practice and a battle-field. Let anyone visit the Wimbledon Camp on a fine July afternoon, and watch the perfect order and composure that prevails in that ad-

¹ No. CXXX, "Royal United Service Institution Journal."

mirably-organized shooting exhibition. He may perhaps notice a veteran champion who looks as if he were laying himself down for a comfortable nap, but whose piece presently goes off with good result at 1,000 yards. Can anything be more unlike the crashing roar, confusion, and excitement of a fighting-line when life is most intense in the presence of death, and when the strongest bonds of discipline and confidence in authority are necessary to draw men to listen for commands and to obey them?

What our soldiers require in peace-time is not long-range target practice (to qualify them as prize shots), but field practice with fire-discipline, to give them steadiness and confidence in battle. Years ago when we were fighting in the Crimea, most of our troops still armed with the old Brown Bess of the Peninsula, this question of fire-discipline presented itself to the minds of the thoughtful chiefs of the Prussian Army, already for some years in possession of the breech-loading needle-gun. Accordingly they instituted the system of "fire-units" or "groups," and so well has this organization (which has been greatly developed since 1870) been recognized as a potent element in the German victories, that it has been introduced into all the Continental armies.

There are generally sixteen of these sub-units in a German company, and in the German Infantry Drill Book (p. 39) it is laid down that each of them shall not exceed six or be less than four files, and thus in the fighting formation, which is in two ranks, the strength of a group would vary from twelve to eight men. It is further directed (p. 64), that:—

"In order to admit of the fire being controlled by the commander, the men of each section are to form a distinct group in the firing-line with several paces interval (in open ground) between each group; and this in order that the non-commissioned officers of the company, who are divided amongst the sections, may exert a proper and distinct control over their men."

Lieutenant Mayne, R.E., who has recently brought out a very able and comprehensive work on "Infantry Fire Tactics," is a strong advocate for the introduction of the group system into our Service. The following is an extract from this work:—

"The advantages which a firing-line divided into groups or commands has over a continuous firing-line, with each man working according to his own lights, are:—
 1. It enables a better control to be maintained of the men, so that they are kept better and longer in hand. 2. It enables a concentrated fire to be kept up even at the shorter ranges, and on the objects required to be fired at. 3. The pauses, so necessary to enable control to be kept up, are facilitated. 4. It conduces to a more rigorous execution of given orders. 5. It helps to avoid waste of ammunition, the group leader having the power of moderating the fire according to circumstances. 6. It permits of a more rational utilization of the cover given by the ground, and of a more energetic advance in the attack. 7. It gives to each man a contact with his comrades in the group, which increases his feeling of security and confidence by the moral protection it affords. 8. It presents to cavalry a series of organized groups quickly formed and capable of efficient resistance."¹

The latest edition of the "German Musketry Regulations (1884)" shows how the standard of the soldier's training is always being

¹ "Infantry Fire Tactics," by Lieutenant Mayne, R.E.

raised as the requirements of war seem to demand. The following extract shows what great stress is laid on the training of the individual soldier: "Cases will occur in action when the company and zug leaders will no longer be able to control the firing. It will then be for the non-commissioned officers and intelligent energetic privates to use their influence on the men of the nearest groups, so that action may be regularly carried on. Under effective fire of the enemy at close range even this method of control must frequently fail, and the result will depend entirely on the individual action of the men. *Hence follows the necessity for so training and developing the individual soldier as to make him capable of working independently, and of making a proper use of his weapon without special directions in each case.*"

The group system is no doubt an admirable device for maintaining discipline in an extended line, especially in the earlier stages of the fight. The Germans do not however trust altogether to their group organization, but as the extract just quoted from their latest musketry instruction shows, they insist on "so training and developing the individual soldier as to make him capable of working independently and of making a proper use of his weapon without special directions in each case." This may be regarded as an impossible general standard of efficiency for all to attain to, and probably it is. What is really aimed at is to be found in the sentence immediately preceding that last quoted, viz., the training of the non-commissioned officers and intelligent privates so that they may be capable of taking the place of the group leaders who have fallen in the fighting-line. This is the backbone without which all mere system or organization will fail. For men to be under control and guidance in battle, there should be a sufficient number of reliable well-trained non-commissioned officers and brave intelligent men who will aid their Officers, or on occasion replace them. Captain Layman in writing of the training of infantry observes:—

"The group leaders are often a dangerous impediment. We imagine we can only keep the skirmishers in hand with their assistance. We therefore look upon the group as the lowest unit, and make too little use of the intelligence of individual men. They are accustomed to being led in leading-strings, for they have the group leaders who think for them. In an offensive engagement, however, after a few minutes there are no longer any decided groups. Here and there, in the vicissitudes of the action, new groups are formed, with which, however, there is not always a non-commissioned officer to take over the command. It then devolves of its own accord upon the most efficient man, whom the others in their need of guidance willingly follow. This may easily happen at a moment or at a point which is of decisive importance. If endeavours have been made to train the men by theory and practice for independence of action in the fight, then—provided that neither the brain nor the faculties required for the training are wanting, nor yet that the quality of the recruits stands too much in the way—a sufficient percentage of men will be found in every company who, both by their character and the development of their intelligence, will render essential aid in the proper conduct of the whole line of skirmishers."¹

This was written very shortly after the war, and is in singular harmony with the latest views of the German authorities. They employ the group organization for the control and direction of fire,

¹ "The Frontal Attack of Infantry," translated by Major-General Newdigate.

giving at the same time the highest attainable individual training to the men so as to provide leaders or nuclei for the new groups when the old ones are dissolved or broken up.

This system of training the soldiers of the German Army seems at first sight to be contradictory, as it demands the strictest discipline together with the exercise of independent judgment. Yet it is based on actual experience in war, and appears designed to meet the unavoidable state of disorder and confusion in the crisis of battle, that time when control of fire can no longer be maintained by ordinary means—when many of the leaders are shot down and others are unable to make themselves heard—when even the groups are broken up or dissolved; then men turn instinctively to those nearest who are able and willing to lead or direct, and then is the time when previous training tells upon all, especially upon those who are able to keep their heads cool and impress those about them with confidence while inspiring them with their own daring. Such men cannot always be picked out in peace-time—they may not always be the smartest men on parade, nor the best conducted off it, they may be often quite unfit for promotion to the rank of non-commissioned officers, yet such men may exercise important sway in battle. In training soldiers to the use of independent judgment, it is not expected nor desired that every soldier should act independently. The majority of men, whether soldiers or civilians, only desire to be led, and by proper training the right men are given the knowledge requisite to enable them to lead aright. But only very good and careful training, and good material, could attain the result aimed at: “that each according to his station should understand how to combine independent judgment and action with due subordination to command.”¹

In our Service we are making a commencement at this sort of training, but it is, I think, much to be desired that we had schools for the education of our non-commissioned officers, such as are established in Germany with so much benefit to their army.

The group system cannot be said to be altogether unknown to us. It was employed by Sir Redvers Buller, for instance, in the Eastern Soudan in 1884, and I can certainly answer for the good fire-discipline of his brigade at Tamai. The “section” system in the “Field Exercises” is at least a recognition of the principle of controlling fire in action by the leaders of sub-units. But the group system is far from being generally recognized in our Service as it is in Continental Armies. Our small companies would greatly facilitate its introduction by enabling us to put each section under a sergeant, and when the section exceeds sixteen, each half-section under a corporal. The great object is to get these sergeants and corporals trained to lead and control their respective commands, and this can only be arrived at by constant practice in peace-time—on parade and in quarters. Our drill, even in close order, might with advantage be made to serve this purpose of training the section leaders by giving them habits of command with a sense of responsibility, and to those under them a habit of subordination.

¹ “Frontal Attack of Infantry.”

We have introduced fire-pauses in our regulations as an effective means of controlling fire, but we have not yet got the machinery for obtaining these pauses, which may be called the touchstones of fire-discipline. We have yet to make it second nature for a man to look to his group leader for orders as to firing, and to pass the words of command when heard; experience also shows that we require a more powerful instrument than the human voice for communicating the order to cease firing in the heat of action. This is now done in the German Service by means of shrill-sounding whistles, as laid down by their latest musketry regulations. The commanders are no longer limited to ordering three rounds only in mass or volley firing, more liberty being given to their exercise of judgment. The leading principle of disciplined infantry fire is concentration in place of dispersion:—

“On the battle-field, the Germans, instead of letting ten men, choosing their own objects, fire eighty cartridges in four minutes on ten different objectives, prefer to concentrate, during half a minute, the fire of eighty men on the same objective, and then have a pause and open fire on the next one, and so on.”¹

Our regulations say—

“The fire must be slow enough to ensure accuracy. Pauses of some length should occasionally be made to allow the smoke to clear away, to judge of the effect produced, to give the necessary orders, and to keep the men steady.”

As stated above, the Germans, and also the French, consider that these pauses should alternate with sudden rapid fire-action, so as to obtain a maximum effect in a minimum time.

The French regulations say—

“The suddenness of fire is one of the principal conditions of its efficacy. The moral influence of a material result is greater as this result is obtained in a shorter time.”²

German writers also anticipate a considerable moral effect from the silence of the pauses, and probably with reason. We may remember Marshal Bugeaud’s account of the effect produced on the French soldiers by the silence and steadiness of the English line when their columns advanced to the assault, shouting as they got near “*Vive l’Empereur*,” with some confusion, and some firing.

“The English line,” he wrote, “remained still, silent, and immovable, with ordered arms, even when we were only 300 paces distant, and it appeared to ignore the storm about to break. The contrast was striking; in our inmost thoughts, each felt that the enemy was a long time in firing, and that this fire reserved for so long would be very unpleasant when it did come. Our ardour cooled. The moral power of steadiness which nothing shakes over disorder which stupefies itself with noise, overcame our minds.”

This frank and generous testimony from a gallant foe has often been quoted, and may serve to remind us, without undue elation, of the high discipline our soldiers can attain to. We may at the same time observe that such forcible expressions as “the moral power of steadiness” and “disorder which stupefies itself with noise” may in these days be made applicable to the steady force produced by fire-discipline as contrasted with the disorder of wild unregulated fire.

¹ “Infantry Fire Tactics,” by Lieutenant Mayne, R.E.

² “Infantry Fire Tactics.”

Our course of musketry instruction requires remodelling to bring it into harmony with the tactical requirements of the day. Great labour has been bestowed on these regulations, which prescribe in minute detail the course to be followed; but they make no allowance for individuality, and are based on the theory that every "man who has no defect in his sight can be made a fairly good shot"—and that individual fire is all-powerful in the field.

The following extract from the "*Militär Wochenblatt*" for January, 1885, gives a German view of our system of musketry instruction (1884).

The writer objects to the routine of work so strictly laid down, thereby allowing no scope for individual instruction; considers that the able recruit is kept back by the slow one, and that the latter can get no proper care or attention. In Germany the recruit's education is built on a sure foundation, whereas in England they seek to make him a rifleman in eighteen days. On the sixth practice day the English recruit shoots at 500 yards. In Germany only a second class shot, one therefore at least in his second year of service, would shoot at that range. In Germany the most important part of the instruction is considered to be the practice at short ranges, whereas in England every effort is directed to get the rifleman to shoot at long ranges as quickly as possible. In his first year the German recruit only fires at 100, 150, and 200 metres, being allowed for each distance 20 rounds. The qualification for shooting at the longer ranges is lower in England, or only 75 points are required to pass into the second class, which might be obtained by 3 bulls-eyes, 5 centres, and 24 outers, that would be 38 misses out of 70 shots. Yet the writer admits that our musketry regulations of 1884 show a considerable advance on those of 1879. The Company Officers are now entrusted with the duties of instructing the men, more rounds are allowed and more attention given to field practice.¹ The value of thorough careful instruction at short ranges is, however, not yet recognized, but every endeavour is made to push on a recruit so that he may fire at long range. This is contrary to the German deductions from the war of 1870-71, the conclusion given in the General Staff Report being that the decisive fire is at short ranges, and that only thorough instruction at such distances can give that sureness of aim necessary to repel a frontal attack in the open field.

I shall not presume to enter on the large question of musketry instruction, which is, I understand, in course of being rewritten, and which would be far beyond the limits of this paper, yet as all infantry fire tactics must be based upon it, I will venture briefly to summarize what I think we want in order to bring the course of musketry instruction into harmony with the requirements of war.

What we want is to have our men thoroughly well trained individually at close ranges. The most important training is field firing under conditions resembling a battle. Men should be taught firing by groups, and judging distance amid the noise and confusion

¹ We have, since the writing of this article, introduced the section on Musketry Fire Tactics in our Field Exercises of 1885.

of a fighting-line, but under rigid control and fire-discipline, taking advantage of cover as if under fire. Our soldiers should also be practised in rapid loading and quick aiming, as they should learn to hit not only with slow but also with quick firing.

We will assume that we have a sound system of musketry instruction and fire-discipline. It is now for us to consider on what general principles the attack of a position should be conducted. The late Colonel Home in his valuable work on Modern Tactics observes: "The attack on an enemy's position is based entirely on the science of the attack on a fortress," but I think the comparison a somewhat misleading one. A regular attack on a fortress with its successive places of arms is a bad model for the infantry attack, although it certainly offers a strong analogy to the conduct of the artillery fire.

Artillery fire tactics do not come within the scope of this paper, so important a subject requires a paper to itself. The conduct of artillery fire in an attack is, however, so intimately connected with the fire tactics of the infantry, that a brief allusion to it is necessary.

In the Franco-German War the artillery, especially on the German side, played a much bolder part than is usually assigned to it in peace manœuvres. Prince Hohenlohe writes: "The war of 1870-71 completely dispelled the old prejudice against allowing artillery to enter within the limits of rifle-fire." In a lecture at this Institution in May, 1883, Colonel Brackenbury stated that "all modern tacticians worthy of the name are of the same mind: they say that though artillery will suffer heavy losses by advancing into the front line in the later periods of the fight, yet the game is well worth the candle."¹ As we all know, there were plenty of instances even in the early battles against trained troops when the German artillery was pushed boldly to the front. At Spichenen the two Prussian batteries came into action on the Rotherberg within 800 paces of the French infantry in shelter-trenches, and although they lost half their gunners their advance enabled the infantry to keep their ground. Borny, Vionville, and St. Privat furnish abundant instances of artillery being boldly yet judiciously handled, and although suffering heavily, giving effective support to their own infantry. The well-known case of the advance of the four batteries of the 7th Army Corps at Gravelotte is an instance of injudicious boldness, but the rule that obtained in the conduct of the artillery was that it should enable the infantry to hold the ground they had gained and expose itself to any loss rather than let the infantry be driven back.

I assume then that our artillery will adopt the same bold tactics in the attack of a position, and advance so as to take up successive positions from whence to silence the enemy's artillery and co-operate with the advancing infantry. Strong detachments of infantry taken from the reserve should always be provided to protect the batteries, who should be furnished with entrenching tools, so as to be able to throw up cover for themselves and the guns. The infantry accompanying the guns might also employ with advantage rifle-fire at long range against the position or against any suitable objective either by

¹ "Journal," No. CXX, p. 439, *et seq.*

mass or volley firing. The objections so strongly urged against the use of long-range fire by the infantry of the attack would not apply to them. They are briefly stated—

1. Excessive expenditure of ammunition, leaving insufficient for decisive fire at short ranges.

2. Loss of attacking power, or offensive spirit, the danger of drifting into a fruitless fire at long range without advance.

3. Difficulty of obtaining or correcting range.

No. 1 is the most important argument against long-range fire, and is decisive against infantry advancing to attack a position. If, however, each battery were accompanied by an infantry ammunition cart (carrying 9,600 rounds) there would be abundant supply for the detachment of infantry, in addition to what the men would carry, so that there would be no fear of their running short of ammunition. No. 2 would not apply, as the infantry would move forward with the artillery, and as regards No. 3, the artillery have superior means for determining the range, which the infantry with them would profit by.

German authorities do not recognize long-range rifle-fire for the attacking force, but unless other objections can be produced than those above, it seems unwise to deprive the attack of so powerful an ally. If, as they say, it is a great disadvantage to the attacking force to open musketry fire at a greater range than 600 yards, then the Russian Krinka rifles in the war of 1877-78 should have given it an advantage, as they were only sighted to that range. In a very interesting lecture in June, 1878, in this Institution, on "Lessons from the Late War," it is stated that owing to their terrible losses from the long-range fire of the Turks, "rough wooden sights were manufactured in some (Russian) regiments and adjusted to the rifles, but as this expedient naturally could not increase the actual carrying power of the weapon it advantaged the Russians but little, and they could not reply with effect to the fire that was devastating their ranks."¹

The proposal to co-operate with the artillery by long-range rifle-fire is not a new one. General Hardinge, in a lecture delivered here in March, 1879, proposed having distinct duties for the infantry of the attack, some to prepare the advance, some to cover its nearer approach, some to reach the ultimate goal.² Similar views have been more recently advocated by Lieutenant Mayne, R.E., and others. There is, however, strong authority against such employment of infantry. Our own regulations say: "The preparation of the attack at long distances belongs to the artillery, it is only in exceptional cases that the infantry can take part in it." The German regulations say that "the preparation for the attack is indispensable, and it would certainly be best to leave it entirely to the artillery so as to avoid a long weary rifle fight." Prince Hohenlohe is strongly against allowing infantry to fire up to 1,000 or 1,100 metres when artillery is available, and gives an account of a competition between a company of infantry and a battery, *at unknown ranges*, in which the

¹ "Journal," No. XCVIII, p. 941, *et seq.*

² "Journal," No. C, p. 402, *et seq.*

result was greatly in favour of the artillery. But the proposal before us is not to compete but to co-operate with artillery, and so get the benefit of the range-finding power of the latter. When you take into consideration, writes Prince Hohenlohe, "the excitement of battle, the comparison will be still more to the disadvantage of infantry, for when the soldier's blood is heated the weapon will shake in his hands, whereas the cannon has no nerves." Prince Hohenlohe has, however, to admit that *gunners* have nerves, and referring later to some bad artillery practice under fire states: "I had to take strong measures to get the gunners to resume a steady and orderly fire" (No. CXXX "Royal United Service Institution Journal"). I do not believe that good infantry, especially when firing from behind shelter-trenches as here proposed, would be in a state of wild excitement, and I should anticipate some good results from controlled volley or mass fire under such conditions even at long ranges when the distance has been determined by artillery.

Our own regulations prescribe placing troops from the reserve in commanding positions on the flanks who are to cover the general advance by volleys. Where such positions exist this would of course greatly strengthen the attack.

Some of the guns must be held in readiness to push on to the positions as soon as taken accompanied by the infantry escort with entrenching tools and ammunition cart. The well-known instance of Skobelev's infantry on the Green Hill at Plevna using dishes and bayonets to get cover shows the necessity of having entrenching tools ready for a lodgment.

The action of the artillery in the attack on a position would therefore be very similar to that of the siege batteries in the attack on a fortress. Concentration of fire, first on the enemy's artillery and then on his infantry, can be most effectively obtained by massing the guns. This method has, however, the objection of offering a large target, and in the attack of a position it may often be found advantageous to follow again the analogy offered by a siege and get a concentrated fire from dispersed batteries with the aid of signals or field telegraph, but all such arrangements would of course depend on the nature and lie of the ground.

So far we have only been considering the fire required to prepare the way for the infantry of the attack. As regards the much-debated question whether the attacking infantry should ever be allowed to open fire at long distances, I think all the experience gained since 1870 goes to show that long-range rifle-fire is favourable to the defence but fatal to the attack if used by the troops designed for the assault. The regulation in the German Service is that every effort should be made to prevent the attacking troops opening a serious fire before they enter the effective zone, 400—500 yards.

Our regulations say that "a premature opening of fire by the fighting-line may lengthen the action and lead to a deficiency of ammunition at the final stage, and thus weaken the moral energy of the assailants." And in the next paragraph, troops are only autho-

rized to begin firing at "medium" distances in open ground, that is, within 700—900 yards of the enemy.

The danger of opening fire prematurely is strenuously enforced in all Continental regulations, and even the Russians, who suffered so fearfully from long-range fire, lay down in their latest regulations that as only close fire is decisive, the long-range power of the rifle must be used with extreme reserve, and then only when the result is pretty sure to justify the expenditure of ammunition.

But the question of long-range infantry fire, as indeed of all infantry fire tactics, is intimately connected with the supply of ammunition in the field, a subject to which too much attention cannot be devoted in peace-time.

The question whether musketry fire is effective at long ranges is only of secondary importance. The important point is, will there be cartridges enough for fire at both long and short ranges? If not, the former must give way to the latter, as we all know that battles can only be decided at close quarters. In defence of a position, where men have their reserve supplies close at hand—like the Turks at Plevna—long-range musketry fire would be most valuable, especially against large targets, such as a mass of guns, cavalry, or infantry columns. Against troops advancing to the attack long-range rifle-fire would always be of great value, especially if the artillery of the defenders has been partially silenced. Independent of its physical effect it would create a strong desire in the attacking force to reply by long-range rifle-fire, thereby delaying its advance and weakening its power for the decisive fire-combat at the shorter ranges. The defenders would also generally have the advantage of firing at known ranges. But for the attack the question of long-range rifle-fire is mainly if not entirely one of supply of ammunition.

"The timely supply of ammunition to troops in action is one of the most difficult services in war. Of what use is the most scientific strategy on the part of the General, or the most heroic conduct on the part of the troops if, at the most critical moment, the latter are exposed without defence to the attack of the enemy?"¹

In our Service each man carries 70 rounds into action, 40 in his pouches and 30 in his valise. This quantity may be increased on an emergency, as at Tel-el-Kebir and in the late Suakin expeditions, when the troops went into action with 100 rounds on their persons. There is, however, some difficulty in getting at these extra cartridges, owing to want of pockets or pouches for carrying them.

"The German arrangement consists of two small tin boxes, placed on each side of the knapsack, and covered with a flap. These two boxes hold all the cartridges which the man's pouch will not take. If a man wishes quickly to refill his pouch, or in case of his being wounded or killed, one of his comrades has but to raise the flap and the box of ammunition is easily got at."²

The Russian soldier now carries 84 rounds, but in 1877 he only carried 60, and General Liddeler strongly recommends that he should

¹ Prince Hohenlohe.

² "Supply of Ammunition to Infantry." Translated by Captain Waller, R.E. No. CXVI, "Journal."

carry 105 rounds, with a corresponding diminution in his general equipment.

In a discussion on a lecture here in June, 1878, Captain Trotter, R. E., stated that in the Turkish Army under Mukhtar Pasha in Asia Minor, "the men were provided each with 150 rounds of ammunition; they carried 50 rounds in their pouches, and the other 100 rounds, some, like the Circassians, in pockets made on the breasts of their tunics, and others in their havresacks . . . or in any other place where they could find room."¹

Our battalion reserve ammunition consists of three carts carrying 30 rounds per man for a battalion 960 strong. It has been suggested to increase the reserve by an additional cart, so as to bring it up to 40 rounds per man (see "Infantry Fire Tactics").

I should much prefer to see a few mules attached to each battalion for this purpose. Eight mules would carry as much as a cart, and could follow the infantry where a cart could not.

Assuming a battalion to have only 800 men in the ranks, then 3 carts and 12 mules would carry 72 boxes of ammunition, or 54 rounds a man. Suppose the battalion had to advance for attack over ground where the carts could not follow, then by issuing 30 rounds per man to the fighting-line and supports (400 men), 20 boxes would be emptied and 15 rounds to the main body would empty 10 boxes more, leaving 42, which for a short-distance could all be carried by the 12 mules. With a carefully prepared equipment, mule transport would be quickly organized on the outbreak of war, but it is most desirable that there should be a detachment of ammunition carriers to each battalion, who should practise in peace-time all the duties connected with the supply of ammunition in the field.²

Some of Prince Hohenlohe's observations on this subject are worth quoting :—

" You cannot, under any circumstances, safely reckon upon providing them (the infantry) with a fresh supply when attacking across the open from the time they get within 500 metres of the enemy to the moment of closing with him. All suggestions which have been made with this object must be considered inapplicable to this stage of battle, however practicable at long range during intervals of inaction, or when on the defensive."³

With this and similar evidence before us we cannot resist coming to the conclusion that as a plentiful supply of cartridges at short ranges is vital to the success of the attack, and as at that period of the fight it is impossible to supplement the supply, the attacking infantry cannot afford to spend ammunition at long ranges. To this may be added the other important reasons for reserving fire as much as possible, which have been already referred to, viz., the delay in advance, and the weakening of the energy of the men. With a good system of fire-discipline fire should not be opened before reaching within 600 yards of the enemy's position, assuming some cover to be

¹ See "Journal," No. XCVIII.

² The regulation first supply for the fighting-line is at present less in our Service than in Continental Armies. The introduction of the solid-drawn cartridge will enable the ammunition to be carried in bags without fear of injury.

³ No. CXXX, "Journal Royal United Service Institution."

available, and up to 400 yards the fire should be under control. Group or section volley firing will be capable of being maintained at closer distances than any other form of controlled fire, so long as the groups can be kept together. This, therefore, is the form of firing on which most stress should be laid in field practice in peace-time.

Infantry fire tactics is too large a subject to be fully dealt with in a short paper, and I have only been able to touch on the main points.

Our next subject, "Attack Formations," is one concerning which it is less easy to get precise guidance, so much depends on the character of the troops concerned and the power of the arms employed; a progressive quantity.

Some sound guiding principles are undoubtedly required, which can be obtained mainly from the experiences of the war of 1870-71. Nothing can be more instructive than the changes in German tactics, brought about by their terrible losses in the early battles of this war. Nothing should more strongly impress writers on tactics with humility and a distrust of the perfection of their own prescribed formations than the fact that the German leaders, with all the foresight and the knowledge acquired during twenty years of careful training with a breech-loading rifle, including two wars, should yet have been ignorant of the breech-loader's actual power in the field, and consequently of the tactics required to oppose to it. At the outbreak of the war the Germans were hampered by their drill regulations, in which the skirmishing line played a subordinate part to close column.

"In field day exercises," wrote Captain Layman, "critics always laid the greatest emphasis upon the numbers which could be brought up *closed* for the decision; the fighting efficacy of the skirmishers was not rightly valued."¹

Under the searching fire of the Chassepôt, columns were rapidly deployed and hurried to the front, and

"without allowing sufficient time for the artillery to take effect, masses of infantry threw themselves into the fight. . . . From the rapidity with which an attack is executed at peace exercises, the leaders are not conversant with the idea that the enemy can only be shaken by a protracted fire fight on their side, gradually brought nearer by a careful use of the ground. The leaders who were fighting in front in the first line very soon urgently demanded support. They were accustomed to consider only those troops fit for fighting who at any rate retained some kind of order, and still preserved a solid nucleus. Now they very soon saw their whole force raffled together in a confused swarm of skirmishers totally extended, and apparently mocking all order and guidance. Thus, by degrees, we see whole divisions extended in a skirmishing line."²

If such unforeseen changes in tactics could be so rapidly produced in an army organized with so much foresight and after so much experience by what must be called undisciplined, unaimed, long-range rifle-fire, who can say what further modifications may have to be made against disciplined fire of far higher intensity, such as may be expected from magazine-rifles and machine-guns at effective range?

¹ "The Frontal Attack of Infantry," translated by Major-General Newdigate.

² "Frontal Attack."

German tactics have been in a state of healthy growth and progress since the war, and the authorities are careful to give no typical attack formation in their Drill Book, so as not to indicate finality, or to relieve the Commanding Officer from the necessity of exercising his own intelligence as to the formation required on any given occasion.

Von Boguslawki, in his last work on "The Development of Tactics since the War of 1870-71," after summing up the course of a frontal attack on a plain, admits that the existing system of attack is far from giving satisfactory results.

"The duration of the fire combat, the enormous losses, the pushing forward of fresh bodies of troops, cause a disintegration and confusion which increase the difficulty of command to the utmost, withdraw the men from the superintendence of the leaders, and make it easier for those of weak moral and physical nature to shirk the danger of the fight. This must be considered the weak point of the existing tactics."¹

This weak point is what we must work at in peace-time. We have now to consider how to adapt our tactical formations so as to retard and minimize this inevitable disintegration and confusion.

"In an army, the less there is of harmony between its regulation tactics and the tactical requirements of the age, the greater will be the confusion attending its infantry attack."²

The leading principle I would propose we should consider as essential to every attack formation, is that of "tactical cohesion." This requires that when the fighting-line is reinforced by the supports, each company should be under the control of its Captain, and that the Commander of the main body should have a wing or double company under him and not merely a certain proportion of men. With this principle in view, I would advocate the half-battalion being organized as a distinct fighting unit.

Some writers recommend a second line or wave of skirmishers to reinforce the first. Probably the supporting force would lose fewer men in this formation, but it would entirely lose the character of a support in the sense of being a physical and moral prop to the fighting-line. Other writers have even recommended that the main body should advance in successive extended lines.

"Such a formation," wrote Home in 1873, "tends not to prevent but rather to produce and perpetuate what is the great danger of this kind of fighting, viz., a gradual cessation of all the elements of regular order, and a gradual dissolution of the whole force into the skirmishing line . . . that formation" (for the supports and main body) "should be adopted, which will enable the leaders to hold the men most thoroughly in hand, keep them completely under their eye, and at the same time advance as rapidly and with as little confusion as possible."

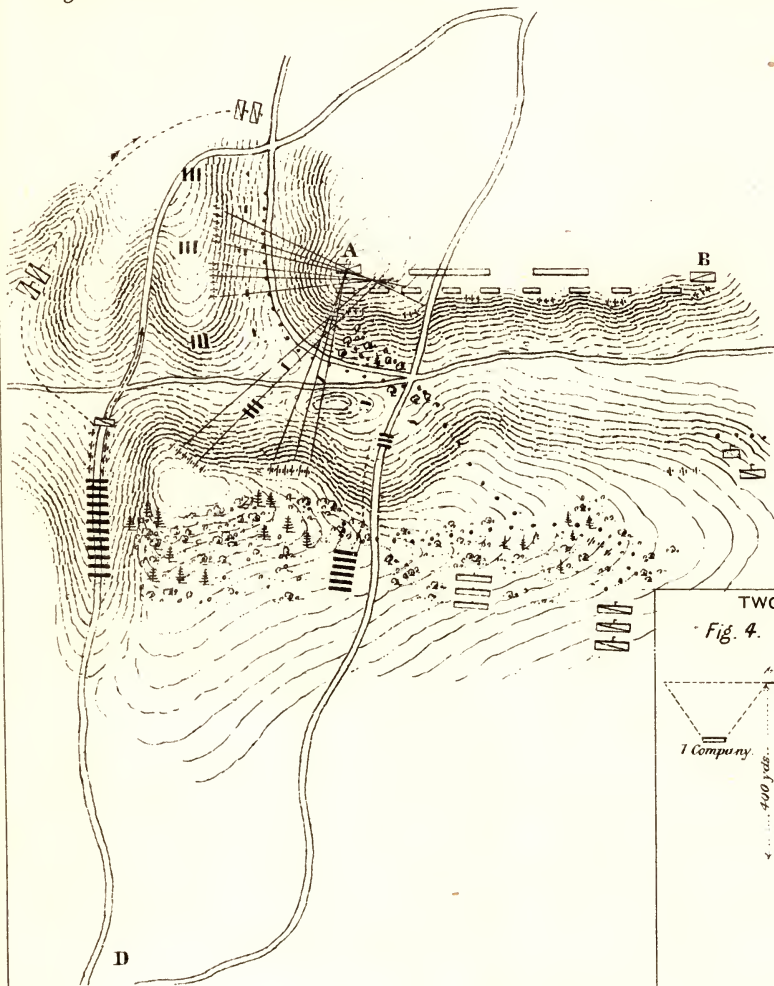
If extended in successive lines, the supports and reserves would not be available for protecting the flanks, as they could only move direct to their front or rear. And yet, with all these palpable defects, this formation is not lightly to be rejected, as it is the one in which Skobelev made his successful assaults at Plevna, and was, he considered, the only possible one.

¹ "The Development of Tactics," by Colonel V. Boguslawski.

² "The Soldier's Pocket Book," by Lord Wolseley.

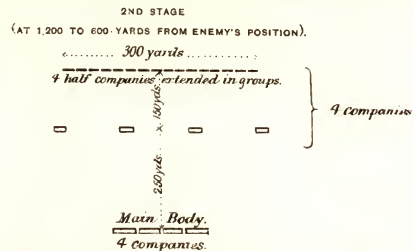
Fig. 3.

ILLUSTRATION OF A FLANK ATTACK



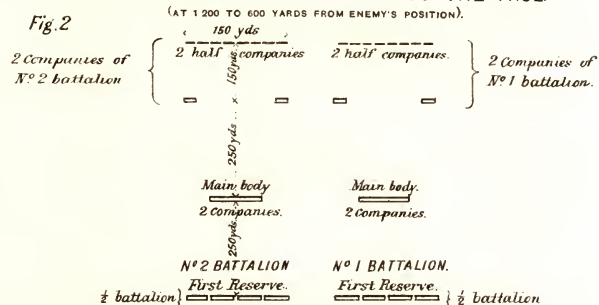
ONE BATTALION IN NORMAL ATTACK FORMATION, HALTED.

Fig. 1.



TWO BATTALIONS HALTED IN ATTACK FORMATION FOR FRONTAL ATTACK. 4 MEN TO THE PACE.

Fig. 2



TWO BATTALIONS HALTED IN ECHELON ATTACK FORMATION WITH SUPPORTS ON FLANKS.

Fig. 4.

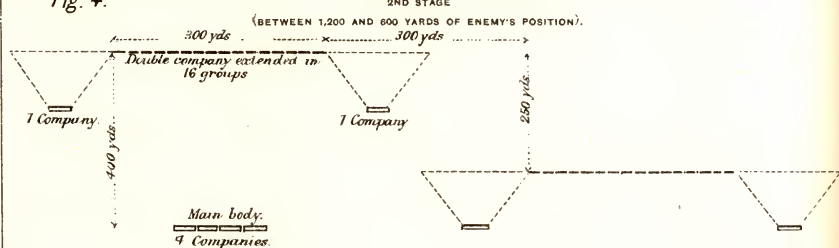
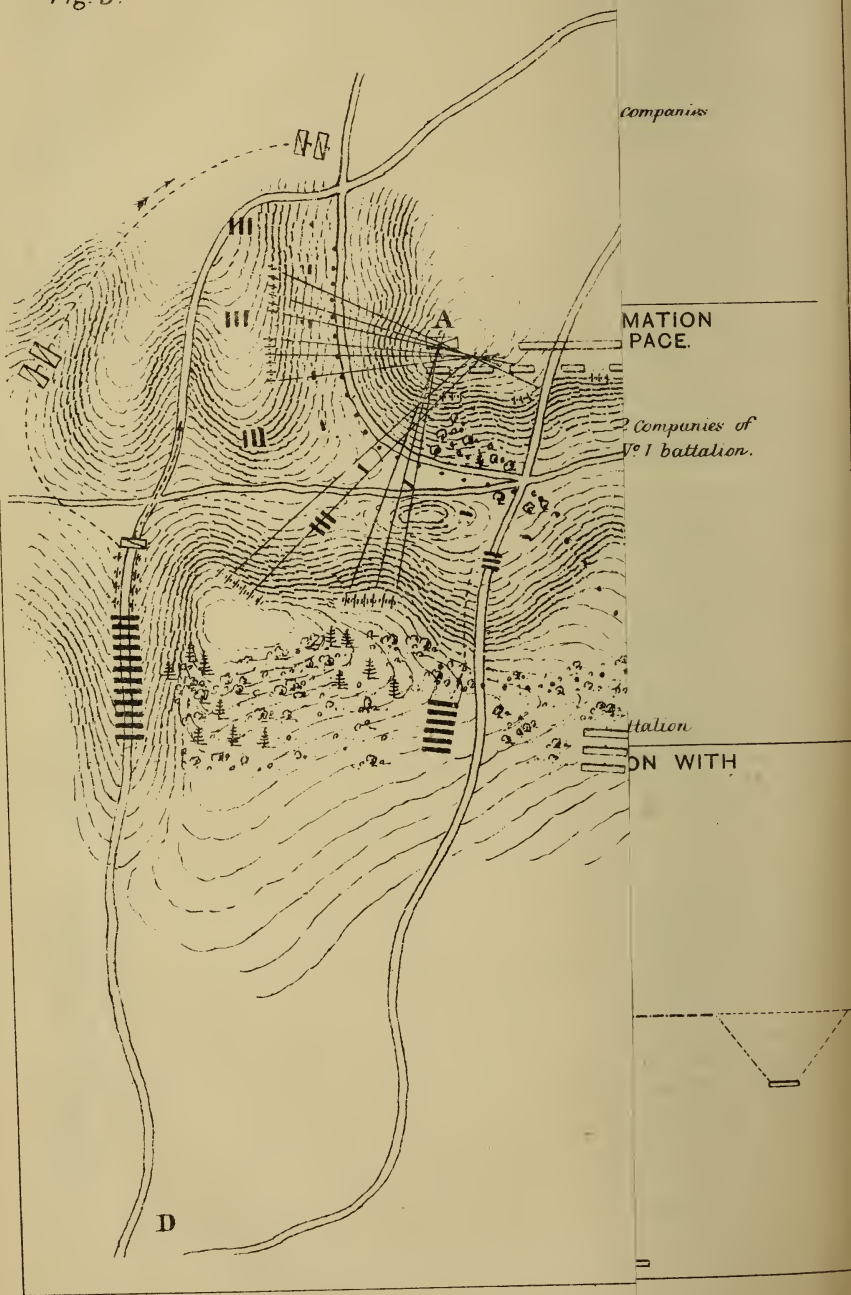


ILLUSTRATION OF A FLANKING, HALTED.

Fig. 3.



The four-deep formation, which is another variety of the wave system, has been very forcibly and ably advocated in this Institution on several occasions by Colonel Macdonald, but as it appears to me that formation involves dissolving all tactical cohesion at starting, and trusting to its being restored by every man coming into his place before the final rush. The principle of tactical cohesion demands that the fighting-line, supports, and main body should consist of tactical sub-units, so that, if required, the supports or main body may be diverted to a flank without producing confusion.

The supports and main body must move in such formation as is best suited to the ground, while enabling the commanders to keep them in hand. Close formation should therefore be retained as long as possible, and, as a general rule, all halts should be in line. Up to 1,200 yards from enemy's position the enemy's musketry may be considered as unaimed fire, so that up to that distance the supports and fighting-line may be kept near together. The advantage of this would be greater tactical cohesion up to the entrance into the zone of "aimed fire," and consequently a feeling of greater confidence in the fighting-line, especially when one or two sections of each company in support is extended in the fighting-line, as will usually be the case.

"It is important to observe that in passing through the 'unaimed shot sphere,' speed alone can diminish the risk of loss. Avoid it, or cross the least intense portion of it, if that be possible, but formation can affect the question in no way whatever, except as it may affect the speed. Bullets are flying at a given rate within certain limits, and if all must pass through those limits the individual chances are not affected by being in company. It would be otherwise reasonable to assert that a body of men marching in skirmishing order would be reached by fewer drops of rain, *i.e.*, would get less wet, than if they passed through at the same pace in column, or that you would get less wet walking alone in the rain than you would do in company with a friend."¹

At about 1,200 yards from the enemy's position the infantry will lie down, the supports and main body previously forming line, and rest while the guns are brought up to prepare their road through the zone of aimed rifle-fire. Beyond this distance (1,200 yards from the enemy's position) it is worse than useless to attempt to lay down on paper drill diagrams showing the various stages of the fight. These could only represent parade manœuvres misleading to both Officers and men, as the extended order exercises should always, when practicable, be performed on broken ground.

"On every instruction parade where there is variety of ground, the Commanding Officer should explain to the Officers the supposition under which the practice is to be carried out, the object to be attained, and the manner in which he proposes to attain it; also the nature of the ground and how it is to be utilized. The Officers commanding companies will repeat this briefly to their non-commissioned officers and men, explaining to them the part they will have to take in the manœuvre."²

Nothing can be more sound and practical, and it is probably better not to fetter the instructions with formal diagrams. A few typical formations are no doubt useful in illustrating principles to be adopted, provided the diagrams are not taken as instructions. With this idea

¹ Colonel Gawler, "Modern Tactics."

² "Field Exercises," p. 212.

I venture to submit three types of suggested formations in what for convenience we may call the second stage of the attack, 1,200—600 yards from the enemy's position. The formation must of course be based on an estimate of the resistance expected and probable force required at the final stage to overcome it, irrespective of reserves, which must be kept ready for emergencies. Assuming a large development of front so that a concentrated fire could be brought to bear upon the enemy's position, then a formation of two men to the pace, such as shown in Fig. 1, Plate IX, might be suitable. If a direct frontal attack be intended, then the formation in Fig. 2, is proposed, giving four men to the pace, followed by two lines of attack in reserve, the half-battalions working as separate tactical units. But of course a frontal attack ought never to be made, as it never would succeed against good troops unless combined with a flank attack. In the German Drill Book (p. 149) it is laid down as a fact to be strongly impressed on their infantry, that their front is unassailable when their flanks are secure, that in such a position they are invincible. "The enemy's bayonets are nothing to them, and even supposing him to have an equally good rifle it will be at a most decided disadvantage, since his movements will not permit of his taking cool and steady aim." Yet front attacks must continue to be practised, as a flank attack may often be tactically a front one.

As stated by Colonel Clery, "the system of breaking down the enemy's resistance by penetration has given way to that of envelopment." The plan of working round positions while tying the enemy down in front was well illustrated by General Gourko in forcing the passes of the Balkans. Fig. 3 is an ideal illustration of a flank attack with a force of equal strength to that of the defenders, taken from the late Colonel Home's work on tactics,¹ of which the following description is given:—"An army, A.B., on the defensive has one wing strongly posted at A. It is induced to spread the other out towards B by a demonstration in its front. The attacking army occupying the wood in its front strongly, place a portion in a state of defence so as to check any advance of the enemy to the front, and seeing that the nature of the ground at A is such that a counter-movement in that direction cannot be easily made, moves round to that flank, preserving the line of communication towards D, and by concentrating a fire on A the attackers are enabled to carry that point."

The containing power of the breech-loading rifle behind slight entrenchments is so great that in future wars we may expect to see battles decided by flank attacks, the side that takes the offensive making a previous demonstration against the front, and strengthening his positions by entrenchments, so as to have all available force at the decisive point. It is, therefore, very desirable that a certain proportion of entrenching tools should be carried by the troops with a reserve supply in wagons.

Fig. 4 is suggested as a type of an attack formation, which may

¹ I have taken the liberty of altering Colonel Home's formation of the supports which in his sketch are shown in columns of two companies.

be in *échelon*, either to gain an enemy's flank or in anticipation of a flank attack. This is a formation on the double-company system, the supports reinforcing to the flanks of the fighting-line. In the German drill regulations (page 143) this method of reinforcing by prolonging the fighting-line is recommended as much more effective than by pushing in between groups. In either case some lateral movement is required from the men in front, and although it is asserted that men will only move straight to their front or rear, yet there are examples to the contrary in the war of 1870-71. At the attack on Le Bourget near Paris it is stated that "the mechanism of the attack consisted principally in the rapid change from open to close order directly the most trifling cover admitted of the rallying of a subdivision or company. On the other hand, every advance over open ground took place in widely-extended skirmishing lines, which moved on like ants."¹

The formation of Fig. 4 involves the necessity of the men in the fighting-line closing in on their centre as losses occur. This is in accordance with our last regulations, and I cannot agree with those who consider it impracticable. This formation would have the advantage, besides that of maintaining the larger tactical units, of not exposing the supports to the fire which would pass over the fighting-line. The supports could also protect the flanks of the fighting-line by volleys when required. In reinforcing the fighting-line the supports would have a definite point to extend from, viz., the flank of the firing-line in their front.

As regards the probable loss reinforcements will suffer in coming up to the fighting-line, a theory has sprung up (based apparently on an incident of the battle of St. Quentin in January, 1871) that the rifle-fire and artillery of the attack will so engross the attention of the defenders that they will allow the reinforcement to approach almost in close formation without much loss.

The well-known German writer, Von Scherff, observes on this point,—

"The artillery, and in a short time the infantry, of the defenders becomes the object of the attackers' fire. It follows that their fire will be directed from that portion of the attacking force which composes the main body (or the true assaulting party). The more the troops charged with the preparation of the attack succeed in drawing on themselves the defenders' fire the better they will do their work. A defence properly conducted will seek not to be so led, but it cannot help itself, though it may, perhaps, avoid directing all its fire on the fighting-line, and may direct a portion on the supports and batteries. If, on the one hand, the fire of the defenders does not check the advance or fighting-line of the attackers, it will be destroyed by their fire, united to that of the attacking artillery. If, on the other hand, the defenders concentrate their fire on the fighting-line they indirectly facilitate the advance of the main body of the attackers. And this is the dilemma on which the possibility of the attack mainly rests, and hence the necessity of giving the troops engaged in preparing the way, a considerable force."

This writer is considered by some as too much of a theorist, and certainly would have found his logic confronted by hard facts had he been present at the fourth counter-attack of the third battle of

¹ Duke of Wurtemberg.

Plevna, which was repulsed by General Skobelev being illogical enough to fire "not on the Turkish firing-line but on their reserves in rear, whom he thus compelled to withdraw, and who were soon followed by their firing-line."¹

It is not wise to build up a theory of attack on the expected blunders of your enemy, and it is very remarkable that the author of the "Frontal Attack of Infantry" should, at p. 27 (of Major-General Newdigate's translation) have penned this sentence: "When the skirmishers are once involved in a fire action with the enemy, closed detachments can come forward with insignificant losses." This very important inference he bases entirely on the following incident: "On the 19th of January, at St. Quentin, two companies of the 8th Rhenish Infantry Regiment, No. 70 upon the right wing of the 16th Division, were brought forward to protect the batteries of the Division from the enemy's infantry fire. One zug of each company was sent out to skirmish with two closed züge following in support at 100 paces; these suffered very severe losses at a distance of 800 paces whilst passing over a hill—one-sixth of the effective state in a few minutes. On the other hand, the two remaining companies of the battalion which were brought over the same height an hour later hardly suffered at all, although no change had taken place in the French position. The attention of the French was now completely rivetted upon the fire action at a distance of about 400 paces." This is certainly a noteworthy incident, but one that could not be *always* expected to happen. Curiously enough the same author, at p. 17, especially warns us "against drawing too rapid and optimistic conclusions from the actions in the second period against the troops of the Republic." This most just observation is apropos to a previous remark upon the quality of the troops opposed to them, and an illustration is taken from the same battle of St. Quentin to show that "against such an enemy even closed attacks could be made without losses worthy of mention."

The lesson for us to draw from these incidents is the all-importance of fire-discipline in defence as well as in attack. When the Germans still had trained troops opposed to them they found it less easy to advance or bring up reinforcements during action. In a lecture by Colonel Hale, in June, 1876, a most graphic description is given of the erratic advance of the 3rd Battalion of the 35th Regiment at the battle of Vionville. The 2nd Battalion endeavoured to gain from the cemetery hill the clumps of trees lying between Flavigny and the high road. "The two foremost companies only succeeded in gaining any ground in this direction, whilst the half-battalion which followed was so reduced by the enemy's fire in crossing the heights that the *débris* had to be rallied at the cemetery."

In reinforcing direct to the front, the control of the fighting-line depends in great measure on the cohesion of the groups, who should push in on the flanks of the groups in the fighting-line, the latter closing inwards as their numbers diminish.

¹ Note, p. 218, "Infantry Fire Tactics."

² German Staff account.

As regards the strength of the fighting-line it is evident that once the rifle-fire has commenced in earnest, say, when within 600 yards, or in perfectly open country, 800 yards, the attacking infantry must be reinforced so as to get a superiority of fire. Beyond 1,200 yards it would be better to have only a weak line of skirmishers, as there would then be less chance of expending ammunition.

For convenience of reference it is necessary to divide the attack into different periods or stages, but it should be clearly understood that this is by no means an arbitrary division, but must of course be regulated by local circumstances. I would propose the following divisions:—

1st stage.—Up to 1,200 yards from enemy's position supports to be close up; one section only extended. Second position for artillery at 1,200 yards with infantry. Latter to fire volleys at this distance in conjunction with artillery.

2nd stage.—1,200—600 yards. Supports 150—200 yards in rear of fighting-line near flanks. Main body 400—500 yards in rear. General rifle-fire opens at 600 yards.

3rd stage.—600—300 yards. Fighting-line gradually reinforced during this stage. Main body brought up within 200—300 yards of fighting-line.

4th stage.—300—150 yards. Advance by alternate rushes. Fighting-line reinforced by main body, and formed for assault at 150 yards.

Something remains to be said on the subject of advancing by rushes, which I have assumed to commence at 300 yards, although it is usual in drill exercise to begin rushes earlier. Like the general opening of fire, "rushing" should be deferred as long as possible, that is, until the men cannot advance by any other method. In our "Field Exercises," p. 227, it is stated in a footnote that "a rush is permissive—not obligatory." The diagram on Plate XXVIII, however, shows the fighting-line advancing by alternate rushes at 500—600 paces from enemy's position.

In the campaign of 1870–71, the German troops suffered heavily from the French long-range fire, but when within about 500—600 paces frequently found the French fire pass over their heads, and that by pushing rapidly forward they escaped loss, and completed the demoralization of the enemy. It was the same with the Russians against the Turks at Plevna. It is hardly safe to infer from this that rapid movements or rushes commencing at 600 yards will be successful against an enemy trained in fire-discipline. If it be true that the rapidity of the attackers' advance will reduce the effect of the defenders' fire, it is no less true that the same cause will also greatly reduce the effect of the attackers' fire. Now this, again, must react upon the defenders, for suppose as an extreme case that the result of the breathless state of handshaking unsteadiness produced by the great exertion of rapid movement should so affect the firing of the attackers as to make it as harmless as blank cartridge practice, the defenders being no longer under effective fire would be proportionately cool and collected, so that their fire would become more concentrated and deadly.

General Hardinge, in a lecture already referred to ("Journal Royal United Service Institution," vol. xxiii), stated—

"That from the results of field-firing carried out in India, it was found that the best effect for the Martini-Henry rifle was obtained between the ranges 900 and 600 yards, because the shorter ranges are only reached by rapid advances, and *this gain of distance is more than counterbalanced by the loss of breath and other physical disabilities which impair the accuracy of the weapon.* Breathless haste may avoid losses, but steady fire can alone inflict it. Speed of movement and steadiness of aim do not go together."

Prince Hohenlohe writes on this subject like a practical soldier:—

"Skirmishers must be made thoroughly to understand that it is only allowable to run in moments of extreme urgency, as running heats the blood and makes the hand unsteady. I am not making any undue demand upon skirmishers when I require them to move steadily and calmly forward under fire, always of course supposing its effects not to be too deadly."¹

The German regulations permit of the advance by rushes when necessary, adding the following caution:—

"The progress of the attack will, however, be retarded by such method of advance, by which much strength is expended, and it must not therefore be commenced at a greater distance than 500 paces from the enemy . . . The general direction that all movements of the fighting-line should be in quick step without doubling may only be departed from in exceptional cases."²

A good suggestion was made by Captain May, in his well-known "Tactical Retrospect of the War of 1866," as regards the necessity for watching over troops during the advance, and especially when it comes to alternate rushes. It is that each company should have an Officer in the supernumerary rank who should be made responsible for the men moving up together.

This paper commenced with a few observations in reply to some criticisms that have appeared respecting the use of square formations against savages in thick bush, whose principal arms were spears, and whose tactics consisted in desperate charges, with hand-to-hand fighting. I wish now, before concluding this paper, to be allowed to make a few remarks on the use of squares from extended order in the presence of an enemy armed with long-range artillery and all the latest engines of destruction. In our Drill Book (pp. 235 and 101), authority is given for the extended line if attacked by cavalry to form groups, when the right and left files of every four will close to each other, and act as required. No objection can be made to this direction, when taken in combination with the previous instruction that infantry if kept well in hand have nothing to fear from cavalry. In the following paragraph, however (p. 101), permission is given to form rallying squares, although Officers are reminded that by doing so "they lose at a most critical moment their power of offence, and become an easier mark for artillery fire." It is a grave question whether such a formation ought to be recognized in our drill as applicable under *any* circumstances to troops in extended order, and under effective fire of artillery. Otherwise it is to be feared that

¹ Translated by Sir L. Graham, "Royal United Service Institution Journal," vol. cxxx.

² "German Drill Regulations," p. 141.

Officers and men will be drilled to form rallying squares on the appearance of cavalry when in extended order, and will accordingly adopt it in the field, or should the Commanding Officer, with truer military instinct, decline to have his men massed into a large target to be mown down in heaps by shrapnel, he assumes a great responsibility, and his men, from their previous teaching, will not feel the same confidence in the group formation as in the square of the drill-ground. It takes also some time to form a rallying square from extended order, and if this formation be intended the order would have to be given on the first appearance of the enemy's cavalry, who might merely make a feint, wheel off, and leave the field free to their artillery to play on the devoted squares. It is not too much to say that an attack conducted on this system against an active enemy would be foredoomed to failure.

The Germans retain the battalion square in their Drill Book, possibly with an eye to its use in their future colonies, but German writers state that it is practically defunct. In our drill instructions for men in extended order, we say that a single man on broken ground has altogether the advantage on his side, but in the German regulations it is stated that also in a plain he has the advantage, and that he need not fear several horsemen, provided he remains calm and collected.

In the war of 1866, there were many instances of cavalry being repulsed with loss by infantry in line or extended order. After Gitschin, where the Prussian Bodyguard, while deployed in line, repulsed the vigorous charges of the Austrian cavalry, an order was issued to give up forming squares, and the only instance of a German square formation during the War of 1870-71 was that of the band of the 5th Jäger Corps at Sedan. At both Wörth and Sedan, cavalry were repulsed by infantry in extended order. To do this, infantry must, however, be well trained in peace-time, so as to have perfect confidence in their arms.

I will venture to quote one more instance of infantry receiving cavalry in extended order before concluding.

In a note by Colonel Sir Lumley Graham in his translation of Prince Hohenlohe, already referred to, there is an interesting notice of an encounter between cavalry and infantry near Mouzon-on-the-Meuse, on 30th August, 1870. A Prussian battalion having one company extended, its right "zug" being thrown forward, the latter was charged in rear by a regiment of Cuirassiers.

"The Captain of the company made this 'zug' face about towards the horsemen, and ordered the whole company on no account to close, but to receive the Cuirassiers as they stood, and only to fire when ordered. The Frenchmen charged home, but being received with a rapid independent fire, at close quarters, were repulsed with fearful loss, their Colonel, 10 other Officers, and 100 men being killed or wounded. The Prussian company did not lose a man, a few being slightly bruised by coming into collision with the horses."

This is an excellent example of what good infantry, well trained and well led, can do when charged in extended order by good cavalry, for the devoted valour of the French Cuirassiers on this occasion certainly entitled them to be called *good* cavalry.

Our infantry is second to none in the qualities of coolness and self-reliance, as proved in many fields, and with the requisite training could emulate or surpass the proudest feats of arms of any other troops.

The real value of this paper will, I anticipate, be in the discussion, and for the convenience of those who wish to take part in it, I will give a brief summary of the different points dealt with.

Training.—Individual training of men to be combined with group-system; thorough musketry instruction with good system of field-practice.

Fire Tactics.—Preparation by combination of long-range musketry fire with artillery. Attacking infantry to reserve fire up to 600 yards if possible.

Supply of Ammunition.—Amount carried by troops and in regimental reserve to be increased. Regimental organization of ammunition-carriers to be formed, and practised in peace-time.

Attack Formations.—Principle of tactical cohesion to be maintained as far as possible. Supports to keep near fighting-line up to 1,200 yards from enemy's position. Frontal attacks to be in formations by half-battalions, giving four men to a pace independently of reserves. Flank attacks to be employed. Echelon formation proposed, with flank reinforcement by supports. Advance to be made steadily, without rushes as far as possible.

Squares from Extended Order never to be formed. Cavalry attacks to be resisted in extended line by group formations.

The CHAIRMAN: My lords and gentlemen, I have now to invite a discussion upon the interesting lecture that we have heard. I am very glad that in the concluding portion of that lecture Sir Gerald Graham detailed very clearly the several points that he had referred to. I think, therefore, in the discussion it would be a great advantage if each gentleman who wishes to speak would confine his remarks to one or other of those topics, and not deal generally with all of them.

Major-General H. BRACKENBURY, C.B.: Lord Wolseley and gentlemen, I should like to say a few words first of all on the question of the squares of which General Graham has spoken. In matters of this sort I venture to think that an ounce of practice is worth a pound of theory. I have read in common with you all a great number of theoretical criticisms in newspapers and in magazines upon the employment of the square in fighting against the Arabs. I think the most powerful argument that it is possible to use in favour of the square formation is this, that General Graham, after having employed squares in 1884, and seeing them then at their best, and perhaps at their worst, employed them again in 1885, and that he has told us to-day that under similar circumstances, having to protect large masses of baggage and animals, he should employ them again. Further, when I was engaged under the late General Earle this time last year in organizing the force at Hamdab for the advance up the Nile, the tactical formation to be employed was very much engaging General Earle's attention. He then questioned the Officers of two Highland regiments who had been engaged under General Graham in the campaign of 1884, and I may say that without exception they all expressed the opinion that the square formation was the right formation to meet the Arabs in. I may also say that after Sir Herbert Stewart's first action at Abu Klea we received a telegram from Sir Redvers Buller, who, I think, we all know to be a thoroughly practical soldier, and who had himself commanded one of the brigades which fought in square in 1884, in these words: "Do not let them get a run at you unless you are in square." I do not suppose we are, any of us, so mad as to wish to employ these squares against trained European troops armed with artillery and

modern rifles, and I will therefore pass to the only other subject in this lecture on which I should wish to say a word. The question of tactical formation is of course a very important one, but I should never myself wish to lay down too hard and fast a rule. I hope that we shall never employ Generals who are not capable of being trusted to choose the best tactical formation for employment at the time, and I believe the British General Officers who will be employed in future wars are to be trusted to do that, and I think it should be left to them. As far as the British soldiers are concerned, I would echo every word that General Graham has said, that our infantry are to be trusted as well as those of any nation in the world. But there is one thing, Sir, that I regret to have to say, and that is, they cannot shoot. Nothing struck me more, perhaps, after our little fight at Kirbekan, than to see the whole faces of rocks, as big as the side of this room, spattered with bullet marks, bullets that could not possibly or conceivably have gone within 20 feet, 30 feet, or 40 feet of anyone at whom they could have been aimed. Of course we all know the enormous mass of lead that is fired away for every man that is killed or wounded, and what does that mean? It means that our soldiers are not trained to shoot as they should be. I would earnestly commend to my brother Officers a little pamphlet by a very able and intelligent Officer, Major Hamilton, of the Gordon Highlanders, Sir Frederick Roberts's first aide-de-camp, called "The Fighting of the Future," in which he puts, almost better than I have ever seen it, this question of the absolute necessity of teaching our soldiers to shoot. I do not know that I should go so far as he does in saying that thirty-five thirty-sixths of the time devoted to the instruction of the soldier should be given to teaching him to shoot, but to give him only one thirty-sixth of the time for shooting, as is practically now the case, must be altogether wrong. The question, of course, that we all have to consider with troops in action is how to sustain the *morale* of the soldier, or in plain English, how to keep up his pluck under a heavy fire, and I am perfectly convinced that there is nothing that would give the soldier such confidence as the knowledge that he could with certainty hit any man that was coming at him, that, in fact, if you gave him a repeating-rifle he could knock ten men down in a rush of 100 yards. If we could at once give him that absolute confidence that he with his weapon could not be approached, I believe we should then really and truly have the very best troops in the world.

Colonel STIRLING (Coldstream Guards): My lords and gentlemen, as a regimental Officer of many years' experience, and one who has paid great attention to drill, perhaps you will allow me to give the experience that is the outcome of my studies. Of course the great difficulty in the attack system against an armed force is to get over the dangerous ground with as little loss as possible, and to bring as many men into contact with the enemy at the final rush as you possibly can. The great difficulty of disciplining the fire of soldiers in open order is the loss of the command under which they started. At the same time, if the Drill Book be taken with a little artistic skill, we could get out of our Field Exercise an attack formation which seems to me thoroughly satisfactory. But I admit that it requires a slight amount of artistic skill. It is given in the Drill Book that you can either extend a company, half a company, or you can extend by sections. In the one case the half company has to cover the whole front of the original company, or the section in a weaker form has to cover the whole front of the company. Under these circumstances the moment you reinforce you immediately lose the sectional commander's absolute command. The men of two sections are higgledy piggledy under the different sectional commanders, therefore I would suggest that in all attack formations extending from the company and equally going on from the battalion, the first and the third sections should be extended, leaving the second and fourth sections in support opposite the gaps of those other sections. You will observe then the result is if men are dropping in the first section they will close as they advance on their directing flank; the second section will come up on their left intact, and you will by that means keep each section under the sectional commanders. And the sectional commanders have a large responsibility in the field, because the companies are enormously larger than any we are accustomed to drill with. If you want the fourth section to come up it goes on the left of the third, and the companies are then in line in sections, in the order in which they started,

and the absolute power of the fire discipline of the sectional commanders is not lost. I venture to think this a suggestion worthy of your consideration.

Captain C. B. MAYNE, R.E. : My lords and gentlemen, the subject upon which I should like to say a few words is that of long- and short-range fire. No doubt advantage is to be got from long-range infantry fire when it can be employed under conditions which are favourable to its use. In an attack it naturally would not be used before the artillery of the defence had been silenced. Between that time and the moment when the actual assault takes place, there is a considerable interval ; it is during this period, the artillery of the defence being silent, and the artillery of the attack being concentrated on the infantry of the defence, that long-range infantry fire should be thrown on the defenders' infantry. It is useless to fire at objects without depth at longer ranges, as far as I can make out, than 900 yards, and as General Harding has pointed out, it is between 900 and 600 yards that the best results are to be got by the moving troops of an attack, and that is practically long-range fire. In the defence, long-range infantry fire is best delivered from advanced posts, to compel the enemy to extend as soon as possible and so to suffer all the evils resulting from a premature extension before coming near the main line of defence, which should trust to short-range fire for actually repelling the assault. In savage warfare short-range fire is the thing. I saw some little firing in Afghanistan, and there long-range firing was not of the slightest use. An uncivilized foe does not appreciate long-range fighting ; he considers the short ranges as his best ones, and he ought to be beaten at them, and not kept off by long-range fire, in which latter case his only thought is, " Let me get at them." General Brackenbury mentioned the bad shooting of our men in the Soudan at short ranges. I think that can be got over if we only made use of something more like the system adopted abroad. In the first place they sight their rifles for a full foresight. Our rifle is sighted for a fine foresight ; the men cannot use it moving rapidly, and immediately they use a full foresight, as they cannot help doing, up goes the bullet high in the air. For all practical purposes I think the full foresight is one of the chief requisites for a military rifle. The second point is the point to be aimed at. We train our men to aim at the centre of a man's body ; that keeps the bullet 3 feet higher above the ground than if you aim at his feet. The men will not adjust their sights, as a rule, under 400 yards ; the Germans and all the other Continental nations accept this and do not expect their men to do it ; they leave the 400 yards sight up, but make up for that by aiming at the enemy's feet. At that range the bullet is always under the height of a man. As we saw from the newspaper accounts in the battles in the Soudan, the Arabs were killed within 30 or 50 yards of the squares. If you draw a diagram under the conditions of not altering the backsight and of aiming at the centre of a man's body, with a full foresight, you will find that the enemy only comes within the power of the bullet at those identical distances ; beyond them it goes over his head. I think that explains a good deal of our bad shooting in the Soudan,—the fine foresights. The men not altering the sights, and aiming at the centre of the body. If this system were altered, we should find the results of our firing in war-time as good as can be got anywhere else. The conditions of firing at a target and firing at an enemy in action are very different, and you cannot expect men to take such careful aim in action as they would when they are not exposed to danger. Consequently a full foresight is better adapted for war than a fine one.¹

¹ It was remarked to the writer that men in action do not *aim*. This is certainly the case at short ranges, but the above remarks apply with equal force if we use the better word *direct*, instead of *aim*. If men are taught and accustomed to direct their rifles low, a better result will be obtained than if they get habituated to direct them high, as English troops are now taught. But men will aim at the longer ranges and at solitary individuals, and in such cases, the writer contends, that a full sight is better than a fine one for many reasons, and that the backsight of the rifle should be graduated for it. In fact, to use a simile, for which the writer is indebted to Colonel Mackinnon, the difference between using a full and fine sight is like the difference between trying to read large and small print. As a

Major BRIDGE, R.M.L.I. : Having had the honour of serving in the late campaign in the Eastern Soudan, I wish to say a few words about the square formation. It seems to me as if the critics who are hostile to squares had overlooked this point, whether the square formation was used simply for fighting, or whether the square formation was used for protection of convoys as the primary object, and in this later case fighting being of secondary consideration. Now, both in the attack on Dhilibat Hill and at Tamai, when unhampered by being obliged to protect convoys, the square formation was *not* used. And above all, in the capture of Dhilibat Hill, the most ardent advocate of the attack formation as laid down in the Drill Book would have seen the principles there enunciated carried out in their entirety. Now, in such a country as the Eastern Soudan, a country intersected by khors and wadis, and also covered with thorn scrub, to have used any other formation but the square formation for protection of convoys would have been madness; above all, when one recollects the Hadendowas, who swarmed in the bush, a race who had no fear of death, and whose warlike and predatory instincts were aroused at the sight of convoys, and who made the most determined and desperate rushes to capture the tempting booty. Now, if the square formation is to be made use of, there are two points which might always be attended to: first, the breadth of the leading face of the square should be regulated by the number of animals you are conveying, for I take it all will agree that the object of a convoy is not to fight, but to get on, and the broader front you move with the easier this will be accomplished, and in a country like the Eastern Soudan, where water was absolutely essential, the getting on of convoys was of the highest importance. Secondly, the pace of the leading face of the square should be regulated by the pace of the animals, and this should be laid down. If thought necessary both these points might be laid down in the Drill Book, but at all events these points should be placed in Field Orders. In the present day one hears a great deal of teaching soldiers to use their individuality: now it seems as if this was most essential when on sentry, above all when one is in face of an ever active, relentless, and creeping foe like the Hadendowas. But the Drill Book is silent on this point, and all soldiers know how very little opportunity is allowed to soldiers to use their individuality when on "Sentry go." Although belonging to a service which in the present day is the only long service one, I must confess that nearly twelve months on active service have caused me to cordially endorse certain maxims in the "Soldier's Pocket Book," a book which I am sure all who have been on active service will agree is worth its weight in gold; these are, first, that short service soldiers, *i.e.*, from 2 to 12 years' service, are out and out the best, as after 12 years' service it seems as if a soldier's sole idea was to obtain a "lazy" billet, and to throw the more arduous work of actual soldiering on his younger comrade; second, the abolition when on active service of the rum ration, for whatever the beneficial effects of it may be, experience has clearly shown me that they are more than outweighed by the evil ones. Just now there is a good deal of controversy about another point—selection; now, of all points, the most essential at all times seems to be selection of Officers for all posts of command.

Colonel G. P. EVELYN: My lords and gentlemen, as the time allowed is exceedingly short I will confine my remarks to the point of the attack formation. In the lecture which we have all heard with so much interest there was a comparison made between the attack of a fortress and the attack of an entrenched position. I think this comparison might be carried further, as the same general principles rule almost

rule, men, even at target practice, use nearly a half sight, showing that a fine sight is perfectly impractical except for crack shots. The writer has made many trials with men using fine and full sights, and has found that practically there is no difference in the accuracy of the shooting, while the men very much prefer the full sight. But the most important point of all in action is to maintain control over the fire of the men. However perfectly the men may have been taught to fire, they will not aim in action unless a control is kept over their fire, and it is a point to be considered whether in any system of musketry instruction in the future, control over fire should not be made a higher object than mere target practice.—C. B. M.

every kind of military operation. It is somewhat curious that in the assault of a fortress, either by storm or escalade, the firing force is quite distinct from the assaulting force, whereas in the advance to the attack of an entrenched position it is proposed that the fighting line is also the assaulting line. Now, either one or the other of these must be wrong, and I am very much inclined to think it will be found that our attacking force should be made into two divisions, one to be called the firing force and the other the assaulting force. The firing force should have a similar duty to perform to that of the clouds of skirmishers who are sent to the edge of the glacis and counterscarp of a fortress to keep down the defenders' fire while the assaulting party advance. My knowledge of drill and military movements extends over a good many years, and I remember in the old days that we used to advance our skirmishers as we did at the Alma, and however successful those skirmishers might be, it was considered necessary, as on that occasion, to recall them before the line advanced. The skirmishers of the light division actually took possession of the enemy's entrenchments, but had to relinquish them on the "retire" sounding. Before the majestic line could advance it was necessary that the way should be cleared, and the skirmishers had to be recalled, and the men who were actually on the outward slope of the enemy's batteries were ordered to retire, and lost a great many more men in retiring than they had in taking the position; and then the second line advanced, and had more difficulty in regaining the ground than the skirmishers had had. Now it is evident that our system in those days was one of retiring skirmishers. If we were to assault such a position as the Alma now-a-days, instead of being so foolish as to bring back the skirmishers we should reinforce them. We have now, therefore, come to the system of reinforcing skirmishers, but I question very much whether that will be permanent. I think we shall still have to change. I think the skirmishers should never be considered as the men to take part in the assault. If a Division has to assault an entrenched position one brigade should be sent forward as the firing force, divided into skirmishers, supports, and reserves to keep down the enemy's fire, and after the fire has produced its effect, the second brigade should advance to the assault of the weakest points of the position, but this should not be till the enemy's position had been thoroughly swept by the fire of the first brigade. If that were the case the fire of the assaulting brigade would be thoroughly under control, but as a rule when soldiers once begin to fire it is difficult to get them to advance. I believe the firing force should keep up a fire as close as they can to the enemy's position, and there remain firing to cover the advance of the assault, who should not be allowed to load till they were past the firing party, and had got as close as possible to the enemy's position. I believe we shall have to make that change. It may seem strange, and it is rather hazardous, for me to attempt to support something different to our present system, but I believe that the system of making our men who fire also rush forward to the assault is a wrong one, that the assaulting column should be kept entirely distinct, and not fire a shot, if possible, till they are almost within bayonet reach. I believe if the rear rank were armed with pikes instead of firearms, and carried extra ammunition for the front men, the force would not lose much in efficiency. We fire too much now; too quickly and at too long a range.

Lieutenant-Colonel the Earl of DUNDONALD, 2nd Life Guards: My lords and gentlemen, there seems to be a favourable opinion with regard to the utility of the square formation under certain conditions against a badly-armed savage enemy, who charge home regardless of their lives. I consider that these conditions existed at Abu Klea. After the successful entry of the Arabs into the square at Abu Klea, that formation was subjected to a great deal of adverse criticism, but I do not think that the breaking into the square was due to that formation. I was in the rear face of the square, and will give shortly some of the causes which in my opinion led to the entry of the Arabs: First of all the right face of the square was longer than the left, in the square were something like 120 camels, this mass of animals being surrounded, as one may term it, by an envelope of men, and the left side of the envelope being shorter than the right there was a natural tendency for the camels to project in that portion of the square where there was least room for them. No doubt, also, there was some straggling, and with regard to this I would make a suggestion on the employment of native camel drivers in a square. It would, it is

true, have been very difficult, if not impossible, for sufficient soldiers to have been afforded at Abu Klea to lead 120 camels, but I do consider it a great disadvantage to have men in a square leading transport animals in large numbers who do not understand English. Also the native drivers sidled away towards the face farthest from where the bullets came from, and, unlike disciplined men, there was no proper order amongst them. There is one other point I should like to call attention to, and that is the difficulty in conveying rapidly the state of matters at the rear face to the front face. It was impossible to see over the mass of camels. I in the rear never saw the front face the whole time, and I would suggest that communication should be maintained from the rear face over the intervening mass of camels by means of signalling, using a long bamboo or other light wood as a staff for the flag. By this means the exact state of matters in rear could be immediately communicated to the front, and the pace and halts of the front face instantly regulated to suit the pace and requirements of those in rear.

General OLPHERTS, G.C.: My lords, ladies, and gentlemen, if I understand aright the reason why we have had this lecture from Sir Gerald Graham, has been partly because some strictures have been made on the use of squares by this most distinguished General in the late campaign in the Soudan. You are all aware that I had not any part in that campaign, I am sorry to say, and therefore, my coming forward to utter anything on the subject may be considered, perhaps, rather presumptuous. We have heard the views of several gallant Officers who were present in the Soudan, including General Brackenbury, for whom we all have the greatest respect as a soldier, upon this question, and it is probable that there are many other Officers here, old and young, who, like myself, were not there, and they may like to hear the views of an old soldier upon the late campaign. But you must remember, my lords and gentlemen, that I am a very old soldier (one of the unemployed), some may even think that I am on my last legs; and it is of course possible that this may be the last time that you will hear my voice in this lecture room. It was only the other day that for want of something better to do I was seriously contemplating forming square in my snuggery, leaving the defence of the outworks to the superior intelligence of my better half! Well now to be practical, having, as I think I have, enlisted your sympathies in my favour. There are two questions which I wish to put to Sir Gerald Graham. We have heard a good deal about the "impenetrable scrub," that you could not go through it, and I must confess that it has always puzzled me how you could move your square through that "impenetrable scrub." I do not understand a large force advancing to attack the enemy through "impenetrable scrub," in the form of a square, or even through a lane cut through the "impenetrable scrub," with no men on the flanks or anywhere else outside the square. That is simply one question that I propound. The next question is this: it has always been in my head, and I am sure it has been in General Brackenbury's, and I can't help thinking that General Brackenbury as an artillery Officer will sympathize with me in this question, though there are a good many others who may not do so. I am myself an old artillery Officer, and I have always thought—forgive me for saying so, it may be presumption—that more light horse artillery ought to have been used in the Soudan than was used there. I want to know why it was not used? You had your base at Suakin, and your ships there, whence you could land your artillery and horses, and I should really like to know why on earth you were advancing with those squares through that "impenetrable scrub" without horse artillery. When I was a young Officer I first of all learnt my work in the artillery, and there I used to practise my battery in forming a square. I learnt that from the old Royal Artillery Drill Book, but I carried it to great perfection, and I could form a square with my battery very rapidly indeed, in less than a minute. It was locked all round, and inside were determined men with their carbines and swords, and all that, and I should have been very happy to have received a good many of those Arabs upon one of my squares. I think if such batteries had been there they could have taken care of themselves, and if they had been at a respectable distance on the flanks, and to the rear, they would have made an impression upon those fellows in the "impenetrable scrub" without much risk to themselves or inconvenience to others. These are the two most important questions I have to put. I commenced by trying to enlist your sympathies with myself as an

old soldier, and I will try and conclude in a somewhat similar manner. When I was in India, and was stationed at Nowgong in the jungles, there was a regiment of cavalry and there was some artillery, and there was my old friend General Alexander Hardy Elliot, now commanding in Scotland, and who can corroborate what I am telling you. There was a sergeant-major of the cavalry regiment who went out shooting one day. He came back and described his experience. He said that he suddenly came upon a lot of wild pigs in the jungle. He had a knack of saying "If you believe me, sir," at the beginning and end of each sentence, and so he commenced his story—"If you believe me, sir, when the pigs saw me, if you believe me, sir, the pigs they formed square, if you believe me, sir." The moral of that is that some of the lower animals instinctively form square when threatened by sudden danger!

Colonel GWYNNE, King's Shropshire Light Infantry: I think there is one point that has been entirely left out in the discussion, namely, the effect of long-range musketry fire on the reserves of the enemy. Granting all that has been said by General Graham as to the loss of effective fire in the attacking line, if it is forced too much, yet it seems to me there is a great deal to be said for the effect of the fire of an attacking force on the reserves of the enemy from a long distance. I have seen very long experiments in India both in field firing and at targets, and it was brought very forcibly home to me and to other Officers like myself, that the effect of this—I won't call it unaimed fire, but missent fire—would have been tremendous on the reserves of the enemy in rear of his front fighting line. I would suggest therefore for consideration, whether it would not be possible for the fighting-line to advance under the protection of bodies of infantry on the flank, who would be firing at the reserves of the enemy. I think there would be great moral force gained by that.

Colonel LONSDALE HALE: There are a great number of us here who I am sure have come to learn, if we can, the results of practical experience in the field. There are a number of Officers present who were out in the Soudan, and who have had that practical experience. One of the points upon which we are all most anxious to obtain information is fire discipline, and if those gentlemen who have lately been fighting in the Soudan and elsewhere will, instead of offering us theory, kindly come forward during the remaining portion of this discussion, and tell us from their own experience how the British soldier, armed with the breech-loading rifle, is to be brought under fire discipline, they will be conferring a great benefit upon those who listen to them.

Major GUNTER, Garrison Instructor, Dover: As intending speakers have been requested to confine themselves to the points specially noted for discussion at the end of the lecture, I will confine myself to the first point mentioned, the training of the men, and will not detain you more than a few moments. I merely wish to observe that the group system advocated is excellent, but it requires constant practice on the part of Officers and men. Thorough efficiency can only be secured by the men being constantly exercised by thoroughly trained company Officers. I think that the training of the men must be more than ever confided to the company Officers, and that every facility should be afforded by the authorities for this, which we have seen of late they are anxious to do. I think also that, if possible, company Officers should be given more men to carry out their training with. I will not detain you further, as there are, no doubt, many Officers of greater experience than myself who wish to address the meeting.

General Sir MICHAEL A. S. BIDDULPH, K.C.B.: My Lord Wolseley and gentlemen, as regards the interesting lecture which we have had from our distinguished friend Sir Gerald Graham, I should like to make a few remarks on the subject of the training of the soldier. I must agree with General Brackenbury in the opinion that the British soldier is not a very good shot, and that every endeavour should be made to improve his shooting. This, I think, is to be effected according to the suggestion which we have just heard from a speaker opposite to me, viz., by handing over the company as much as possible to its commander, and making him the chief drill instructor of the body of men under him. I should like to observe that the shooting of the enemy, such as a Zulu or Arab, is very much like the shooting of a snipe, or the shooting of any wild animal. You have very little time to think about how you are to do it, and how you are to have your piece exactly aimed at

this wild creature. The action of the soldier is very much the same as that of the sportsman. The soldier has to aim and fire at appearing and disappearing targets, at targets moving towards him and from him, and right and left of him, and as of course it is almost impossible for anybody to alter their sights during the interval when the enemy is crossing the last 300 or 400 yards, our men should be taught to deal with that part of the range by appreciating the distance without touching the sight, and this is really the practice now, and I only lay emphasis on this point. As regards one more question, if I may be allowed to change the subject. In the attack of a position I agree with the lecturer that the artillery should be placed well on the flanks, and that due opportunity should be given to it to reduce the power of the defence, and that they should be associated with large bodies of infantry, if such can be spared, to assist in such reduction, and that when it shall be reported or considered that a sufficient impression has been made on the enemy that then the attack should be launched. I also agree that independent rushes should be as little as possible resorted to, but that the men should be brought up to a close distance by superior command, firing little, if at all, the struggle being decided as much as possible at the last by the bayonet.¹

Colonel Sir LUMLEY GRAHAM: My lords and gentlemen, I only speak for the purpose of eliciting information, because I am one of those who only stay at home and remark upon what is done by our gallant friends who are fighting abroad. But I was one of those who, when we read the accounts of the battles from the Soudan, were inclined to doubt the advantages of the square, not from a defensive point of view, but when used offensively. I could not help thinking—and I am going to end what I say with a question to our gallant lecturer—that if instead of putting the whole force available into the square or squares, a part of that force could have been used so as to act independently, the offensive movements would have been much more practicable and effective. If General Graham will allow me I will deal with one particular case in which he held the command, at that grand action in which everyone behaved so splendidly—Tamai; if I understand the position correctly, his two squares had to advance over an open sort of plateau right up to a deep donga or ravine, which deep donga was full of the enemy. If I understand the ground rightly, there was a possibility of turning the flank of that donga. I should like to ask General Graham whether, with his now complete knowledge of the character of the enemy and of everything that has happened since that time, he thinks it would have been possible to have used a part of his force, say in the form of double companies, each double company acting independently, as they would in attack formation against civilized troops. I do not mean to say necessarily in extended order, that might or might not be according to circumstances, whether, I say, these companies might not have been used to turn the flank of that donga so as to facilitate the action of the advancing columns or squares. In fact, my own idea about this question, which I submit very humbly to those who have had practical experience of the matter, is that only a sufficient portion of the force should be kept back for the purpose of acting as a baggage guard in the shape of a square to protect the impedimenta, and that all other troops available should be used for offensive action in handy and pliable formations. With regard to what General Graham has said upon fire discipline, also upon the use of groups, I was very much struck indeed. I am sure that the group formation is of the utmost importance. By using the group formation as in Germany, and as Captain

¹ I think from the reply made by Sir Gerald Graham to my remarks that he did not quite realize my imperfectly expressed simile; the fault may have been mine. I maintain that an advance of savage and athletic warriors, such as has been frequently made of late years on our troops, appears a very difficult and constantly moving target for the men to hit, and that instruction should be devoted to teach success in dealing with such an enemy by fire as he approaches. I should like to observe that the most able riflemen known, the Boers and Swiss, are superior to the rank and file not only of our own Army, but of every other. I did not make this remark in reply, as the hour was late, and I thought it might well find a place as a note to my speech.—M. A. B.

Mayne points out so brilliantly in his book, which I have read with the greatest interest, you are enabled to get over a great difficulty that exists in warfare of the present day, that of controlling your fighting-line, because when the Captain has formed a sufficient number of group leaders he can depute the command of certain portions of his line to them.¹ Then with regard to fire discipline, that of course is one of the most important subjects of the day, and I was delighted to hear General Graham draw attention to it in the forcible way in which he did. We all agree upon the point that it is necessary to make a soldier shoot well, as a *sine quâ non*, but we are not all agreed exactly as to the way of doing it. I think, however, that there can be very little difference of opinion on the fact that one of the most important branches of the soldier's firing education has been very greatly neglected by us at home. It has been carried out to a far greater extent in India. I refer to field-firing. We want plenty of that, not only to train the soldier to shoot, but to promote fire discipline, and to teach the Officer how to handle his men under fire.

Colonel GORDON IVES, Lieutenant-Colonel Commandant 18th Middlesex Rifle Regiment: Perhaps I may be permitted to add a few suggestions that have occurred to me, and which I submit to your consideration in all humility. For more than twenty-five years have I been devoted to this subject. I cannot but think that we should examine our instruction books, and see if the first stages of our training are correct. Look into our drill books, and it is easy to perceive that there are two distinct drills taught, each on a separate principle to the other. There is the old drill founded on the wheel or part of a circle, and there is the more modern drill chiefly on straight lines. It is most difficult to teach the young soldier the distinction in a short time between the two. Moreover, I venture to think that in both systems and in all our drill books there is a tendency to teach the very thing we do not want done. The men are taught to keep together, to touch not in mind but in body, and thus they are taught to do what is certainly not difficult but natural to them, all men and animals being inclined to crowd together in danger. But to crowd together to-day is to be destroyed. Surely what we want is to teach men to keep apart, to keep away from one another, and yet to remain together with as much cohesion of movement as is possible. A method of carrying this training out occurred to me when shooting some years since in Germany, and it is this: fall in on parade at all times in four lines—each line of which is a section—each section divided in groups of eight men under a non-commissioned officer, the men standing 30 inches apart. The advantage of this is that standing on the same space you now do, you avoid telling off altogether, and you have the men completely under control. But its really greatest superiority consists, I venture to submit, in that you have your front line ready to commence an attack at once, easily placed in the proper direction, and you avoid that difficult and dangerous movement of having to extend men in the proper direction at a time when they are most excited and most difficult to control. All the most valuable works on training in all countries attach great importance to this. There are many here who must have seen over and over again how liable men are to extend wrong. It is so late that I will conclude. I have given you my idea, to work it out more in detail would

¹ One at least of the audience having misunderstood the meaning which I wished to convey in this sentence, I think it well to make that meaning clear. Far from wishing to reduce the tactical influence of the Captain in battle, I feel as strongly as any one can feel the necessity of extending that Officer's powers both in the field and in quarters as far as is compatible with the due exercise of the battalion commander's authority over him, and I would even give him more importance than he ever can possess under our battalion organization, by adopting that which prevails in all the great Continental armies. But as with the present system of tactics in civilized warfare the Colonel can only direct his battalion in battle through the action of his Captains, so the latter can only control their companies efficiently when in the fire-line through the action of their section and group leaders. It rests then with the Colonel to form good Captains, and with the latter to form good subalterns and non-commissioned officers to lead their sections and groups.—L. G.

take too long, I could speak for two hours on it, but I will only thank you for having so kindly listened to me.

Colonel Right Hon. J. H. MACDONALD, Colonel Commandant Queen's City of Edinburgh Rifle Volunteers: I should not have spoken, as I wished to hear from experienced Officers in the room their views with regard to the different points of this lecture, had not the Officer who has just sat down alluded to the proposals that in my humble way I have made upon this subject. He will forgive me for mentioning to him that the very thing that I have always stood up for most strongly is that men should fall in in four-deep formation with arm's-length interval and without any telling off, and that the strength in men should be known by the number of their sets of four, or rather, as I should prefer, by the number of their groups of eight. The enormous advantage of that is this: that whatever the force may be that you put upon the ground, 12, 18, 20, 40, or 100 men, your mode of action is exactly the same in moving to the front. There is one objection made by the lecturer to that idea, and one only as I understand, and that is, that it gives you a support and a main body, or what I would rather call a first reserve than a main body, it gives you them within the same unit, and he objected to that on the ground that if they are of the same unit, they are not available for the purpose of being moved off to the flank for any purpose that may be required. I make two answers to that. In the first place, that same objection applies equally to dividing a company, cutting it into four lengths, into sections, and splitting up one section—skirmishing—following with the others. You equally in that case have to move those who are supporting the first section out of the fighting line, and equally break up the tactical cohesion if you move support or main body to a flank. The other answer is this: I think that some of the most eminent military men, whose works I have read, and whose statements in this theatre I have heard, say that no force for the purpose of making a front attack should be allowed to be in any doubt or fear about its flank. We all know that in modern warfare there should be no excuse whatever for a force sent out to attack being surprised upon its flank if proper provision be made beforehand for protecting its flanks.¹ I should be glad if the lecturer would kindly answer one or two ques-

¹ Referring to Sir Gerald Graham's observations in reply, I would like to say that it is of the very essence of the four-deep system that each rank of fours is a tactical working unit. They are in fact the true sections, the "groups" for work, while the eight men of each double-four are more the molecules of which the eight atoms have an attraction of cohesion, so that there is a tendency to recovery of cohesion, in spite of the necessity of an order with intervals, and a greatly increased rapidity of recovery of order from the necessary confusion of the final part of the engagement. If there is recovery of the unity of the small molecules, the sortation of the mass is made infinitely easier. This has been tried, and the result was a success beyond expectation in going through the roughest ground. As regards the mode in which the supporting ranks of fours are to be moved forward, they are not to be moved as the lecturer supposed, in a "loose formation," but exactly as suits the ground and the circumstances. It is intended always, even when drilling on flat and open ground, to practise Officers in moving these supporting portions of the company in forms suited to ground described, such as through a wood, over undulating ground with cover, fenced ground, &c., &c.; the general principles applicable to different circumstances being laid down, and the Officers instructed as to the best form, or absence of form, to adopt. They would then be left to themselves during the advance and reinforcement, and given complete control of their men, to bunch them or thin them out, or file them in a "follow my leader" fashion, according to the ground they were supposed to be on, and the supposed direction of artillery fire, &c. They should here comment on what they had done, that errors of judgment should at the close of the forward movement be pointed out, not in a way of fault-finding, but instruction. At present all our attack drill on the flat is mere form, and impresses the mind with the idea that supporting bodies are to be moved with the same exactitude and absence of change of form as a company on parade, and neither Officers nor men are really taught how to act. As regards moving to a

tions which occur to me as an amateur reading the accounts of the war in the Soudan. The first is this: on the occasion when a severe attack was made by strong bodies of Arabs for the purpose of breaking into the square, I want to know whether the fire discipline was conducted in the way of working the firing as independent firing, or whether it was entirely by volleys. And I may say one would like to know which of those plans Generals who have been in the field would prefer systematically to use. Of course, I do not say that under certain circumstances one might not be preferable to the other, but I should like to ask whether a succession of volleys were used, or whether it was attempted to crush the attack by continuous and independent firing. The other point is this: whether in the formation of a gigantic square for the purpose of acting as a convoy, or when in consequence of the nature of the ground and the enemy you had to meet, the square formation is the best, whether it would not be advisable to have inside the square something of the nature of a separate force, not forming part of the sides of the square. I ask that question for this reason, that it must be perfectly obvious to every one, if these savages, coming in the form of a dense mass, do succeed in reaching the face of the square and getting close up to it, still more if they are able to push it in to any extent, the firing of your own square becomes a very dangerous and difficult operation for your own men, because firing at Arabs or other savages who have pushed in the fighting face of your square, you are very apt to kill your own men as well. I would ask whether some physical force might not be free in the square for the purpose of keeping the square out, if necessary, by actual mechanical force, so as to leave the men more free to fire upon the enemy outside.

Sir GERALD GRAHAM: It has given me great satisfaction to hear so many Officers get up and make comments which I may consider generally favourable to the views I have expressed, and in all cases these comments are of great value. I would allude more especially to Major-General Brackenbury's remarks. He is a great authority on this topic, having just come himself from the Soudan, where he has had an opportunity of seeing the nature of the enemy we had to fight with. Taking the question of squares first, I think that the only remarks that are called for from me are with reference to Colonel Macdonald's inquiring as to whether there should not be a reserve in the square. I perfectly agree that there should; and I should certainly advocate having something like double companies on the flanks, so as to have an interior force independent of the outside line; and, in fact, that suggestion struck me as a very good one, because you could bring them out if required and develop your front. One does not think of all these things at the first, but if we had to fight again in squares I should do that; and, in fact, at Abu Klea we understood there was a reserve in the square. We were accustomed to consider that nothing could break a British square, and therefore we did not take steps for such a contingency. Still it would certainly be desirable, not merely for that object, but for the purpose of developing the fire, to have something in the nature of a reserve in the square. Our object in the square was to cover the baggage animals, and we generally found we had not any men to spare after doing that. Camels and baggage animals are apt to straggle, and their loads break down; the result is the squares get extended, and you find you never have men enough to do the work to keep a complete guard all round your baggage animals. We did not consider the square as a fighting formation, but as a defensive formation for the convoy. I am very glad to see that squares are backed up by an Officer of such long standing, and whose gallant deeds are so well known, as General Olpherts. He asked how we could manage to get through the "impenetrable scrub" with a square. Well, I should say we could not, nor in any other way; but I never used the expression, and therefore I am not responsible for it. The scrub was not "impenetrable" as we proved by getting through it.¹ I quite agree with him as to

flank, I refer to what was said above, space does not permit me to enter into that matter, but I can only assure the reader that it has not been forgotten, and creates no real difficulty.—J. H. A. M.

¹ General Olpherts was, however, quite right. I *did* use the expression "impenetrable."—G. G.

the great advantage of horse artillery; we had a battery on the last occasion, and therefore I can speak personally to their use in the Soudan. Colonel Macdonald asked what was the nature of the fire we used in the squares. It was not always the same. At Tamai, as you are aware, the second brigade was firing independently; the fire of the first brigade was by volleys. At El Teb the firing was independent. Firing by volleys I consider infinitely better. At close quarters it is vastly superior, enabling the commander to maintain discipline. As regards the group system in extended order, Sir Lumley Graham mentioned the great advantage of its relieving the commanders of companies from the almost impossible duty of giving orders to the whole extended line. I do not know that I quite apprehended Sir Lumley Graham's meaning, but I am inclined to think that those commanders of companies in most cases would still retain control by means of the agency of the group leaders.

SIR LUMLEY GRAHAM: That is what I meant to convey—my words probably did not convey my meaning—they would facilitate the control of the companies through the action of the subordinate leaders.

SIR GERALD GRAHAM: I consider that one of the most important duties of the group leaders. They do not take the control out of the Captain's hands, but enable him to exert it. Sir Lumley Graham asked me another question with regard to the fighting at Tamai. Of course if I had known exactly where the enemy were, and what I know now, I might have acted differently; but at the time we advanced on that khor one certainly did not know that we were so near to them. In the next place we fully intended to take them in flank. My information led me to suppose that the enemy were more to my right. I went to the left with the intention of taking them in flank, but they must have moved up to the left also. The result was, we came upon them very unexpectedly. It is ground you cannot see. You may be close to a khor and yet not know that you are there. The ground is very rocky, and at the entrance to the khor was extremely precipitous; you might come within a few yards of it without seeing it was there. No doubt we could do better if we had perfect information, but it is impossible to get that information. I am glad to see that an Officer of such great experience as an artillery Officer as Sir Michael Biddulph approves of co-operation with the artillery. He also expressed my own opinion strongly as to the necessity of fire training being conducted by the company Officer. I cannot agree with him in his allusion to snipe-shooting. I am afraid we could not train a soldier to be a good snipe shot,¹ that is rather too high a standard. What we want is to make him obey orders in action, and if he will at the shorter ranges keep his sight up to 400 yards and fire steadily and coolly, he will do just as well as if he was an accomplished shot; whereas at the longer ranges he must take his orders from his commander, and not fire wildly on his own judgment. I think our system of musketry instruction should rather be regulated with a view to enabling soldiers to act coolly and steadily and take orders in action, than to make them good shots. A certain extent of good shooting is absolutely necessary, but it should not extend beyond the shorter ranges, say 600 yards; trying to make a soldier shoot at longer ranges, and imagining that he could get such dexterity with his weapon that he would be a good snipe shot is, I am afraid, going beyond our powers. I quite agree with what Major Gunter has said on the group system: it is not a thing that can be taken up readily in the field. It is a system that requires constant practice and training by company Officers, and I endeavoured to express that opinion in my lecture. I am afraid I have answered very imperfectly the various remarks that have been made. Captain Mayne, who is most competent to speak on this subject, has restricted himself to the great advantage of having a full foresight and aiming at the feet. I agree that the latter is a detail of musketry training that should be generally adopted. Some tactical points have been entered into by two or three Officers, and I think I understand Colonel Stirling's proposal to be that the first and third sections when extended should close to their right, and

¹ I fear that I misunderstood Sir Michael Biddulph, who only meant "snipe-shooting" to be taken as an illustration of the rapid aiming and quick firing required from men in action. I quite agree with the view, as I have already expressed in my lecture.—G. G.

the second and fourth sections should come in on their flank. That would quite agree with my views upon the subject, and where you have those two sections extended I think that would be a very good proposal. I quite think it would be a very good thing to have men directed to close at a certain point, whether to the centre or to the flank, and that the supports should know where to come to. Colonel Macdonald made some remarks on his own system. I confess I am unable to agree with any system which brings up supports and reserves in a loose formation. It appears to me you should keep them together at starting, and that they must be tactical sub-units. If Colonel Macdonald means that his four lines are tactical units then I should agree with him so far. I am afraid that the formation could not be maintained on broken ground, but I may be wrong. It is one of those points that I do not pretend to enter into, but I am very glad to get information upon them.¹ I have already stated in my lecture that it is a modification of the wave system, which is advocated by Skobelev, and therefore it is one that I say should not be lightly rejected. I would conclude by thanking all who have taken part in the discussion, and those who have done me the honour to listen to my lecture, and you, my lord, for kindly presiding on this occasion.

General OLPHERTS: With regard to what General Graham said concerning the phrase that I used of "impenetrable scrub," I beg leave to withdraw that phrase and to substitute for it Sir Gerald's own term "dense scrub," but I am still unable to understand how a large square could be moved through a "dense, thorny scrub."

The CHAIRMAN: Ladies and gentlemen, it is a very late hour of the evening. The discussion has been prolonged considerably, and it is not my intention therefore to go over the various points which have been so ably discussed. I am sure we are all deeply indebted not only to the lecturer but to those who have taken part in this discussion. Very useful information has been conveyed to us, and I think I am justified in saying, certainly in one instance, that it has been conveyed to us in a very amusing form by one whom I am very glad to see here and to meet again; I have met him upon many occasions in former years under very different circumstances and in very much more exciting times. Allusions have been made to the criticisms which were published when we were absent from England upon the formations that had been adopted by the various General Officers who had the command of troops in the field. Of course it is very natural that all military actions should be criticized, and when criticisms come from Officers like my friend Sir Lumley Graham and others, who are entitled to express their views and opinions, I think such criticisms not only do no harm, but do a great deal of good to the Army as well as to those who have been actually engaged in the operations concerned. I confess I have read some of the criticisms myself when in the Soudan with a great deal of amusement. Some were very foolish, silly, though some were worth reading; but I think, if I may venture to draw a comparison between them, the silliest of all that I read were the criticisms in "Blackwood's Magazine." I do not know who wrote them, and I should be sorry to know the name of the author, for they were evidently the ideas of a very theoretical gentleman who certainly had taken very little part in war, and who most certainly had never seen a Soudan Arab, or been in a Soudan desert. I shall not say much about the square formation beyond this one fact—and I only refer to it because I think General Graham has omitted it—that when you have to fight for your lives, as you have when you are cut off in a desert far from all possible aid—for you must remember what the Soudan deserts are, Abu Klea was 150 miles from all help—when you are entirely cut off from all possible help you have to go into action with the knowledge that unless you win you die. There is no half measure; you must win. You have to think of your soldiers and the *morale* of your soldiers, and unless you make your soldiers feel that should they be wounded they will be well taken care of, and will not be left on the desert to have their throats cut by the first Arab that meets them, I do

¹ I meant to say that I have no practical experience of this system. My theoretical objections are: the difficulty of keeping the supports and main body in hand, and the impossibility of moving them to a flank.—G. G.

not think you can expect to get the most out of them that they are capable of giving you. That is a very important point, for it is only by the use of the square formation in such a desert that you can ensure the protection of your wounded. I should call the advance in square formation a defensive-offensive operation; that is, you go into action knowing that before the actual hand-to-hand phase is reached there will be a certain amount of fire entailing the loss of a considerable number of men; but the vital thing you have to think of and to prepare for is, that determined charge of a body of fanatics who come upon you determined, if they cannot win, at least to die. Such a charge is nothing like a charge of cavalry that can be well met now by determined infantry in line. Any one who has ever seen a charge of cavalry knows very well that after all the man who rides the horse has nerves and a heart, and that if he is met by stubborn resistance nine times out of ten he will sheer off before he reaches the square: he won't go in straight on the square, and his horse very likely won't face the bayonets. But these Arabs who charged our squares were determined to get at the squares. It is all very fine to say you ought to have received them in line, and if you had they never could have reached that line, but all I can say is that they actually did charge and were fired upon and did reach our squares; and if they reached the square I imagine they would have reached the line. The square was a defensive-offensive formation. It received a determined charge, and the moment the charge was delivered and the enemy beaten back, the men composing it were then free to act according to circumstances; they might deploy or adopt any formation that was thought necessary or advisable in that moment of victory. So much as regards the square formation. General Brackenbury has made some remarks to which I attach the very greatest importance, because as you know, gentlemen, he assumed command of one of the two columns into which the offensive operations were divided in the recent campaign up the Nile, after the death of my great friend General Earle, and he conducted them in a manner that was not only creditable to himself but to the fame of the force he commanded. I think he has been a little too hard upon the British soldier as regards his firing. I confess that that is not my experience. Remember that after all good shooting is relative. If you compare a man who can shoot 99 woodcocks out of 100 shots with a man like Tommy Atkins, or any man you pick up in Whitechapel and teach to shoot for two or three years, of course there can be no useful comparison at all, but if you will compare the shooting of the British Army with that of any other army in the world, I think we can hold our own. I think we shoot quite as well, as far as I have been able to examine the histories of the shooting of other armies, as the armies of any other nation. Of course you can teach some individuals to shoot remarkably well, but taking a mass of men, because an army is a great mass of average men, I believe out of every thousand soldiers you examine in any army, you will find that 10 per cent. cannot even see at 1,000 yards, much less hit an object at that distance. I am really not exaggerating; they certainly could not, I believe, see a man on horseback a thousand yards off. Therefore to talk of making every man a good shot in our Army is practically impossible. However, I do not at all wish to say that we have no room for improvement as regards shooting, and I hope that as years go by an improvement will be effected. I think the Army shoots better this year than it did last, and much better than it did five years ago, and as we go on developing the system of confiding to the company Officers the duty of teaching their own men, the better men will shoot. Reference was also made to the subject of ammunition, and we have been told that the advantages to be obtained from long-range firing are rather exaggerated. I have no wish to go into this very long subject, but I confess that I do not agree with those who attach no importance to long-range firing. I believe myself that long-range firing properly used, and used by men firing volleys who can fire without interfering with the first, or as some call it the shooting line, aided and assisted by machine-guns, will render it very difficult indeed for field artillery, to hold its own against such a description of fire. It is a fire that does not require the very careful training that accurate shooting at short distances does. I wish I could ascertain how many of those who are here have ever shot a moving stag at 200 or 300 yards. I am certain that many of those whom I have the honour to address have in the days of

their youth often without success shot at men at long ranges ; I confess that I have seen many an excellent snipe-shot miss over and over again a man at 200 or 300 yards distance. Shooting a man at 300, 400, or 500 yards is a very different thing from shooting at a target ; it is not so easy as people generally imagine. I have often heard people say " What very bad shots that regiment is composed of ; see, there is a man running away at 500 or 600 yards off, and they have all missed him." I should like to have seen those critics firing themselves, for had they done so, they would have found that shooting an individual man in action is not so easy after all. As regards quantity of ammunition and our being afraid of long-range or any other description of firing, because it would exhaust our supplies, all I can say is, it is the bounden duty of those who have the management of our Army to take care that the British soldier may and shall have an unlimited supply of ammunition to fire away when the day of action comes, and when you do this for him, I believe, as General Brackenbury said, you have every reason to feel confident that he will make very good use of it. As it is so late, I will say nothing further, but will convey our best thanks to the lecturer and also to those Officers who have taken part in this discussion.

Friday, March 5, 1886.

ADMIRAL SIR F. LEOPOLD MCCLINTOCK, KT., F.R.S.,
Member of Council, in the Chair.

AIDS TO NAVIGATION: STATIONARY AND FLOATING
LIGHTS, WITH A DETAILED DESCRIPTION OF THE
FOSTER COMPRESSED GAS SYSTEM, AS APPLIED TO
LIGHT TOWERS, BUOYS, TORPEDO AND SUBMARINE
BOATS.

By H. G. HUNTINGTON, Boston, U.S. America.

"Naviget; hæc summa est."

VIRG. ÆN.

The CHAIRMAN: Ladies and gentlemen, instead of the lecture which was to have been given by Admiral Arthur "On the Results of the Naval Operations in Berehaven," which has been postponed, we have to-day a lecture "On Aids to Navigation; Stationary and Floating Lights, with a detailed description of the Foster Compressed Gas System, as applied to Light Towers, Buoys, Torpedo and Submarine Boats," by Mr. Henry G. Huntington of the United States. This is a highly interesting subject to many of us, and although few people have had sufficient scientific education and practical experience to be able to grapple with a great deal that is to be said, I yet hope that in the audience whom I have the honour of seeing before me there may be some who are sufficiently acquainted with this matter to raise upon the lecture an interesting discussion. The subject of portable gas is not a novel one at all; it has been raised many years since. When gas is cut off from the generator and highly condensed it becomes conveniently portable, and therefore it is now coming into rapid use for lighting the beacons and buoys along the coasts of this country, and of a good many other countries also. I have no doubt that everyone in this room is aware that the Corporation of the Trinity House is constantly engaged in improving the lights along our shores, and that it has only recently concluded a most exhaustive series of experiments for the purpose of arriving at the proper value, as an illuminant, of gas, of oil, and also of electricity. But besides being valuable as an illuminant in our homes, gas has another peculiar feature,—it contains so much condensed energy in itself that, in this respect, it can be aptly compared with gunpowder. I will not further encroach upon your time, but will now ask Mr. Huntington to read his paper.

FROM the earliest times the nations of the earth have appreciated the aids to navigation afforded by lights on important headlands as guides to harbours or warnings of dangers.

The first lighthouse in the world was the famous Pharos of Alexandria, of which the ruins may be still recognized. Pliny informs us that it was built by one of the Ptolemies, about 285 B.C. It was of white stone, square, of many storeys, and diminished upwards to a height of 512 English feet. It cost nearly 200,000*l.* sterling. The fires lit in its highest storey were visible, Josephus says, about 30

miles. The Romans had full knowledge of the usefulness of light-houses, and not only in their own country, but wherever they conquered other nations, did they establish these aids to navigation.

Without following farther the history of lighthouses through the middle ages up to our own time, it may perhaps be suspected that the number of wrecks in proportion to tonnage is greater now than then. This, however, is a simple conjecture that cannot be decided and of no practical importance. Probably no countries in the world possess finer systems of lights than Great Britain and France, yet in these days when all quarters of the globe are constantly visited by the world's commerce, an enormous quantity of wrecks occur that might be prevented were more care taken to protect navigators when in dangerous waters.

Light-vessels with a crew of men aboard, beside their first cost are a large annual expense, and their great bulk renders them dangerous and difficult of management in typhoons, hurricanes, and heavy seas. They have been frequently carried away, dragged from their moorings, or broken their cables, and during absence from the danger they were intended to warn navigators off, disastrous wrecks have occurred. Every landsman knows it is not the open sea the mariner fears, but the approach to land, and in the careful statistics of wrecks by the Board of Trade, we find that in the nine years ending 1883, out of a total loss of 15,569 lives including crews and passengers, only 1,334 occurred by vessels foundering, while nearly one quarter, or 3,580, occurred through strandings. The balance of total loss in this period was made up of collisions, missing or other causes.

We find that out of the total registered tonnage of the same nine years nearly 33 per cent. were totally lost. For example, in the whole number of registered British ships at home and in the Colonies, out of a total registered tonnage of 8,406,251 tons, 2,717,725 were totally lost. At this rate the whole registered tonnage of Great Britain and her Colonies is lost each generation. The country in the end has to bear these losses, and shipowners are heavily taxed in the premiums they are forced to pay for insurance.

In the present depressed state of the shipping trade these burdens are still more acutely felt, for in prosperous times the profits compensate in a measure for such charges, while at present the enormous outlay incident to shipowning makes that business not only unprofitable but ruinous.

Economy and efficiency are the present studies of all Governments and private undertakings, and so convinced have the authorities in this country been of the value of a serious study of various systems, that experiments were ordered by the Board of Trade at the South Foreland, to test the merits of lighthouse illuminants.

Until the present time, no Government has undertaken so valuable, thorough, and exhaustive experiments in regard to the penetrating power of light in all conditions of atmosphere, as these which have been carried out by a Committee of the Elder Brethren of the Trinity House during the past year. In their report we have been presented with most carefully compiled and exact statistics by the first authorities on light

in the country, whose observations extended over so long a period, and were so conscientiously made, that their results may be considered as having successfully answered the problem they were instructed to solve as to the relative merits of electricity, gas, and oil. The general conclusion of all these experiments has, however, demonstrated the utter inefficiency of even the strongest light known to the present time, in a dense fog.

From the above report we learn that on the 17th of May, 1884, from 1 A.M. to 3 A.M., "a thick and homogeneous fog" completely obscured the electric light at 1,900 feet, oil at 1,700 feet, and Wigham's gas at 1,400 feet.

Here we have electricity with a force of 1,500,000 candles, through cylindrical belt and vertical condensing prisms giving only 500 feet better results than Wigham's 108-jet gas through a Mew Island lens, whose illuminating power in a clear atmosphere is put at 59,000 candles, and while the electric light is nearly twenty-five times as powerful as the gas, its powers of penetration in any condition were not shown to be as great in proportion, and Mr. Vernon Harcourt's statement as to the superior penetrating power of gas light over electricity of equal candle power is fully confirmed by these experiments.

It is proposed in this paper to deal more particularly with the question of gas-lighting as applied to lighthouses and buoys, as the report of the Committee has clearly demonstrated, that when properly developed, Douglass's gas burners used, and processes adopted that offer greater economy in its production and greater purity and brilliancy in its quality, gas is destined not only to largely supplant oil, but can be made superior in penetration to equal candle-power electricity, whose first cost and subsequent maintenance exceed in a marked degree the first cost and maintenance of a gas station, as described in this paper.

This is easily seen by referring to the table of comparative cost of lighthouse illuminants prepared for the United States Government, and showing the relative cost of lard-oil, petroleum, and coal-gas.

The only gas besides coal-gas used by the Trinity House Commission was that made from petroleum by a German process, the light from which, on the Metropolitan Underground Railway and on some Continental lines, cannot be considered an unqualified success.

The gas tower used in the experiments at the South Foreland was marked B, the electric light tower A, and the oil tower C. In the C tower gas pipes also were introduced up its centre column, and laid to each trimming stage, so that burners might be readily attached to them, and both different kinds of gas and burners compared with those in B tower.

There were submitted three specimen sets of burners, two of the Douglass pattern, one six-ring $5\frac{5}{8}$ inches in diameter, its flame condensing to $3\frac{3}{4}$ inches in the focal plane, and the other $8\frac{5}{8}$ inches across, compressed to $5\frac{1}{2}$ inches at focus; two of the Siemens regenerative pattern, one producing a flame 10 inches in diameter and 6 inches high, the other a smaller flame 4 inches by 4 inches; and one Sugg six-ring burner, with a cylindrical flame $7\frac{1}{2}$ inches in diameter,

controlled by a cylindrical glass, $8\frac{1}{2}$ inches in diameter and $8\frac{1}{2}$ inches high.

These burners were carefully tested, with the result that the Sugg burner was discarded from the lighthouse lantern because evolving too large quantities of smoke, and the smaller Siemens burner was decided to give too little light to be useful in a lighthouse.

The comparative tables of these burners will be found later on marked B.

But to continue the comparison between gas and electricity, the following table taken from the Trinity House Report and marked A will be found useful. In notes to the next table, not shown here, we find that "for fixed lights in all kinds of weather the gas is generally superior to oil."

TABLE A.—*Showing Comparison of Electric Light by Eye-measurement with highest powers of Gas and Oil, both Revolving and Fixed. The assumed value of the Electric being 100.*

| Number of observations in clear weather. | | Electric. | | Average of recorded values. | | | | Percentage of superiority of | | | |
|--|-----|-----------|---------|-----------------------------|------|-----------------------|-------|------------------------------|------|--------------------|-------|
| | | | | Gas. Quadriform 108 jets. | | Oil. Triform 6 wicks. | | Electric over gas. | | Electric over oil. | |
| R. | F. | | R. & F. | R. | F. | R. | F. | R. | F. | R. | F. |
| 38 | 42 | Single.. | 100 | 73 | 61 | 67 | 54 | 27 | 39 | 33 | 46 |
| 190 | 98 | Biform.. | 100 | 65.25 | 61 | 60.25 | 53 | 34.75 | 39 | 39.75 | 47 |
| 79 | 23 | Triform | 100 | 63 | 70.5 | 60.3 | 68 | 37 | 29.5 | 39.7 | 32 |
| 307 | 163 | | | | | | | | | | |
| Number of observations in weather not clear. | | | | | | | | | | | |
| | | | | | | | | | | | |
| 29 | 3 | Single.. | 100 | 70 | 80 | 66.6 | 72 | 30 | 20 | 33.4 | 28 |
| 126 | 40 | Biform.. | 100 | 72 | 58 | 68 | 49.25 | 28 | 42 | 32 | 50.75 |
| 68 | 18 | Triform | 100 | 52.6 | 51.6 | 50 | 46 | 47.4 | 48.4 | 50 | 54 |
| 223 | 61 | | | | | | | | | | |

NOTE.—The numbers for the fixed gas and oil lights are at times higher than those for the same lights when revolving. This does not mean that the fixed were better than the revolving lights, but that the standard electric fixed light was not so superior to the fixed gas and oil lights.

The relative power of electricity, gas, and oil in weather not clear, at great distances, is admirably described in the same report.

It appears that at distances under 5 miles, quadriform gas and triform oil were better than biform electric. As the distances were increased the electric light seems to have come to the front. The permanent electric lights are reported as showing up well, although the experimental electric light was so much impaired at the short ranges.

Again on December 6th, 1884, in a fog and drizzling rain, we find that the observations unanimously indicate that triform electric is little if at all better than quadriform gas or triform oil, and that the single electric arc with three machines is much superior to the triform arrangement.

On February 16th, 1885, in a dense fog and very heavy rain, the summary of results by four observers is given as greatly in favour of the single electric light with double current, but although its candle force is so superior to gas and oil, yet we find that its superiority over both is only a distance of 200 feet, not a steamer's length !

Mr. H. B. Dixon's Photometric Experiments.

These were so important and thorough that I venture to quote from his report on the determination of the total light of each illuminant, electricity, gas, or oil, but the general result may be roughly stated as showing but little difference between oil and gas.

The only object of these notes is to demonstrate the advantage of an economical system of gas over oil in saving expense of first cost and maintenance.

Mr. Dixon says the illuminants submitted to trial were:—

A. The De Meritens electric light, with one, two, and three magneto-electro machines.

The carbons used were "solid," "core," and "bundle" carbons.

B. The Wigham gas burners with 28, 48, 68, 88, and 108 jets.

The Douglass argand gas burners with 10 rings and with 6 rings.

The Sugg argand burner with 6 rings.

The Siemens regenerative burners, large and small.

The gas used was cannel gas of 20 to 30 candle-power, and oil gas of 40 to 45 candle-power, per 5 cubic feet.

C. The Douglass oil burners with 6 wicks and with 7 wicks.

The Service oil burner with 4 wicks was also tested for the purpose of comparing it with the other illuminants.

A. The Electric Light.

The electric light was tested with the bar-photometer at a distance of 220 feet. Ten readings were made alternately by Mr. Vernon Harcourt and myself. In making the reading no attempt was made to measure the sudden intense flashes of a second or two duration, or the equally brief extinctions of light which occur from time to time with the electric arc. Each reading represents as nearly as may be the average light over a period of 20 or 30 seconds; the mean of the 10 readings gives the average light over a period of four or five minutes.

1 Machine. 40 mm. Solid Carbons.

Results.

| | | | |
|----|-------|----------|---------------------|
| 1. | 8,430 | candles. | H. B. Dixon. |
| 2. | 9,200 | " | A. Vernon Harcourt. |
| 3. | 8,880 | " | H. B. Dixon. |
| 4. | 8,880 | " | A. Vernon Harcourt. |

8,850 Mean.

1 Machine. 30 mm. Core Carbons.

Results.

| | | | |
|----|--------|----------|---------------------|
| 1. | 9,890 | candles. | H. B. Dixon. |
| 2. | 10,770 | " | A. Vernon Harcourt. |
| 3. | 11,640 | " | H. B. Dixon. |
| 4. | 11,190 | " | A. Vernon Harcourt. |

10,870 Mean.

2 Machines. 40 mm. Solid Carbons.

Results.

| | | | |
|----|--------|----------|---------------------|
| 1. | 14,530 | candles. | H. B. Dixon. |
| 2. | 10,660 | " | A. Vernon Harcourt. |
| 3. | 12,510 | " | H. B. Dixon. |
| 4. | 13,320 | " | J. Sparling. |
| 5. | 13,040 | " | H. B. Dixon. |

12,830 Mean.

2 Machines in quantity. 81 Bundle Carbons.

Results.

| | | | |
|----|--------|----------|---------------------|
| 1. | 11,420 | candles. | H. B. Dixon. |
| 2. | 18,870 | " | A. Vernon Harcourt. |
| 3. | 18,630 | " | H. B. Dixon. |

16,310 Mean.

2 Machines in series. 81 Bundle Carbons.

Results.

| | | | |
|----|--------|----------|---------------------|
| 1. | 13,900 | candles. | H. B. Dixon. |
| 2. | 13,600 | " | J. Sparling. |
| 3. | 12,500 | " | A. Vernon Harcourt. |

13,330 Mean.

These results show that in the photometric gallery two machines do not give double the light of one machine in the electric arc. The

"core" carbons gave a better result than the "solid" carbons. Afterwards core carbons of 40 mm. diameter were obtained, and were used in A tower.

B. Gas Burners.

The Wigham Gas Burner.

The Wigham 108-jet burner was tested with different consumptions of cannel gas with the following results. Each result is given by the mean of ten observations with the bar and with the table photometer.

| No. | Illuminating power in candles. | Corrected rate of consumption of gas. | Value of gas. | Duty. Illuminating power per cubic foot of 24 candle gas. |
|-----|--------------------------------|---------------------------------------|----------------|---|
| 1 | 2,249 | 295·3 | 27·6 | 6·62 |
| 2 | 2,252 | 302·0 | 24·9 | 7·20 |
| 3 | 2,295 | 312·4 | 25·7 | 6·86 |
| 4 | 2,331 | 319·5 | 26·06 | 6·73 |
| 5 | 2,433 | 351·4 | 25·7 | 6·47 |
| 6 | 2,425 | 368·2 | 25·7 | 6·15 |
| 7 | 1,683 | 214·8 | 41·6 (oil gas) | 4·52 |

The highest illuminating power was given with a consumption of 350 feet, the highest duty with a consumption of 300 feet per hour. The burner did not consume oil gas to the same advantage as cannel gas.

The smaller sizes of the Wigham burner were tested with the following results:—

| Burner. | Illuminating power. | Corrected rate. | Value of gas. | Duty. |
|---------|---------------------|-----------------|---------------|-------|
| 88 jets | 1,400 | 246 | 25·4 | 5·38 |
| 68 " | 992 | 160 | 25·8 | 5·77 |
| 68 " | 822 | 150·8 | 21·8 | 6·03 |
| 48 " | 677 | 112 | 26·0 | 5·56 |
| 48 " | 572 | 109·7 | 22·0 | 5·69 |
| 28 " | 249 | 45·2 | 26·7 | 5·05 |

2. *The Douglass, Sugg, and Siemens Gas Burners.*

The Douglass 10-ring argand burner was tested with different consumptions of cannel gas in the same way as the Wigham 108-jet burner:—

| No. | Illuminating power. | Corrected rate. | Value of gas. | Duty. |
|-----|---------------------|-----------------|----------------|-------|
| 1 | 2,323 | 197.3 | 27.6 | 10.20 |
| 2 | 2,594 | 231.6 | 27.6 | 9.73 |
| 3 | 2,619 | 271 | 25.7 | 9.02 |
| 4 | 1,915 | 136 | 41.6 (oil gas) | 8.12 |

The illuminating power increases as the rate of consumption is raised from 200 to 270 feet, but the duty is greatest with a consumption of about 200 feet.

The other gas burners were tested with the following results:—

| Burner. | Illuminating power. | Corrected rate. | Value of gas. | Duty. |
|--------------------|---------------------|-----------------|----------------|-------|
| 6-ring Douglass .. | 825 | 101.2 | 27.6 | 7.02 |
| " " .. | 853 | 72.8 | 41.4 (oil gas) | 6.79 |
| 6-ring Sugg..... | 824 | 195 | 22.0 | 4.61 |
| Large Siemens .. | 600 | 90.1 | 22.0 | 7.27 |
| Small Siemens ... | 194 | 39.0 | 22.0 | 5.39 |

The 6-ring Douglass burner gave the best light with a consumption of 100 feet an hour, with oil gas its illuminating power was increased, and its duty but slightly diminished. The Sugg burner evolved large quantities of smoke, which made it impossible to burn it in the lighthouse lantern at its full power. As the smaller Siemens burner gave too little light to be useful in a lighthouse, it was not tried in the experimental tower.

C. The Douglass Oil Burners.

The 7-wick and 6-wick oil burners were tested in a similar manner to the gas burners. The 6-wick burner gave a very constant light, the 7-wick showed greater variations.

| Burner. | Mean illuminating power. | Mean consumption of oil per hour. | "Duty" light per gallon per hour. |
|-------------|--------------------------|-----------------------------------|-----------------------------------|
| 7-wick..... | 947 | 1 gallon | 947 |
| 6-wick..... | 730 | 0.625 " | 1,168 |

Similar tests were also made of the larger Douglass burners, and of two smaller burners in the lighthouse service. Although these

burners were not entered for competition, a comparison of their illuminating power with that of the 7- and of the 6-wick may be of interest.

| Burner. | Illuminating power. |
|--------------|---------------------|
| 9-wick | 1,785 candles. |
| 8-wick | 1,400 " |
| 7-wick | 947 " |
| 6-wick | 730 " |
| 5-wick | 620 " |
| 4-wick | 415 " |

Taking the average of the measurements made on the clearest nights, the intensity of the beam of each illuminant as a revolving light is given in the following table:—

| | Eddystone lens. | Mew Island lens. | Cylindrical belt and vertical prisms. |
|------------------------|--------------------|---------------------|---|
| <i>Gas.</i> | Pyres. | Pyres. | Pyres. |
| Douglass, 10-ring..... | 105 | 94 | |
| " 6 | 92 | 70 | |
| Wigham, 108-jet..... | .. | 59 | |
| " 88 | .. | 54 | |
| " 68 | .. | 48 | |
| " 48 | .. | 42 | |
| " 28 | .. | 33 | |
| Sugg, 6-ring..... | 55? | | |
| Siemens (large) | 10* | | |
| <i>Oil.</i> | | | |
| Douglass, 7-wick | 60 | 49 | |
| " 6 | 64 | 48 | |
| Service, 4-wick..... | 55 | 44 | |
| <i>Electric.</i> | | | |
| 1 machine | .. | .. | 1,250 |
| 2 machines | .. | .. | 1,500 |

* This is the illuminating power at the centre of the beam. Owing to the construction of the burner, the edges are much brighter than the centre, so that the cone of light thrown by the annular lens is much brighter at its edges than in the middle. As the lens revolves the observer sees two flashes of bright light, with a dull light between.

These values divided by the previously determined illuminating power of each unaided lamp give the lens-factors for each illuminant:—

TABLE B.

| Burner. | Illuminating power of naked light. | Illuminating power through lens in clear atmosphere. | | | | Factor of lens. | | |
|-----------------------------|---|---|--------------------|---------------------|------|-----------------|------|-------|
| | | Cylindrical belt and vertical prisms. | Eddystone lens. | Mew Island lens. | V.P. | Ed. | M.I. | |
| Electric, 1 machine..... | 10,000 | 1,250,000 | .. | .. | 125 | | | 37·6 |
| " 2 | 15,000 | 1,500,000 | .. | .. | 100 | 42·0 | | 84·8 |
| Douglass, 10-ring, gas..... | 2,500 | .. | 105,000 | 94,000 | .. | 111·5 | | 25·7 |
| " 6 " | 825 | .. | 92,000 | 70,000 | .. | .. | | 38·6 |
| Wigham, 108-jet, gas..... | 2,300 | .. | .. | 59,000 | .. | .. | | 48·5 |
| " 88 " | 1,400 | .. | .. | 54,000 | .. | .. | | 61·8 |
| " 68 " | 990 | .. | .. | 48,000 | .. | .. | | 132·0 |
| " 48 " | 680 | .. | .. | 42,000 | .. | .. | | |
| " 28 " | 250 | .. | .. | 33,000 | .. | .. | | |
| Sugg, 6-ring, gas..... | 820 | .. | 55,000 | .. | .. | 67·1 | | |
| Siemens, gas..... | 600 | .. | 10,000 | .. | .. | 16·7 | | 51·6 |
| Douglass, 7-wick, oil | 950 | .. | 60,000 | 49,000 | .. | 63·2 | | 65·8 |
| " 6 " | 730 | .. | 64,000 | 48,000 | .. | 87·7 | | |
| Service, 4 " | 415 | .. | 55,000 | 44,000 | .. | 132·5 | | 106·0 |

Shown through annular lenses the smaller flames are far more economical of light than the larger, the larger flames, however, have the advantage of throwing a broader beam and so producing a longer flash than the smaller. But the larger flames have a distinct advantage over the smaller in thick weather, for the light from the large burners is less cut down by haze and mist than the light from the smaller burners.

It is not intended to follow this highly interesting report further in quoting from its detailed statements, but only to add a summary of some of the conclusions arrived at in regard to gas, which seem to be—

First. That for a revolving light, the large flame of gas has a distinct advantage over the small flame of oil as respects the duration of flash.

Second. That gas offers peculiar advantages for producing short flashes by sudden extinction and re-ignition, and also for producing atmospheric thrills, which are of great value in a fog.

Third. That the general result of sky-flashing is not favourable to its adoption.

Fourth. That light for light there is no practical difference between gas and oil flames, seen through the annular lenses of a revolving light, but that four superposed gas lights are a little better than three 6-wick mineral oil burners.

Fifth. That the heat of the Wigham burners in quadriform is a serious objection to this system.

Sixth. That for lighthouse illumination with gas the Douglass patent gas burners are much more efficient and economical than the Wigham gas burners.

Seventh. That the electric light is absorbed more largely by haze and fog than either the gas light or oil light.

The complete inutility of even the strongest lights in thick weather cannot but suggest to the thoughtful inquirer, whether it would not be safer to protect dangerous outlying reefs, shoals, and low coasts by a system of gas-lit buoys burning day and night, with a light 15 feet above the sea, visible in clear weather from 6 to 10 miles, and in a fog distinguishable several hundred feet.

That such lights exist, and can burn continuously from six months to one year, we have abundant evidence in the official reports of the first authorities in the United States on the Foster gas-beacons and buoys, and in the award at the International Fisheries Exhibition, London, 1883, of the highest premium, a gold medal, to the Foster gas-buoys.

There are many parts of the British Empire where navigation is difficult and dangerous, and where light-vessels have been carried away on account of the large surface they offer to the wind and waves.

Intricate channels, usually impossible of navigation by night, could be easily marked by gas-lit buoys painted of distinctive colours, and made visible by reflected light masked by a screen, which would be beneath the buoy-light proper. Such dangerous navigation as the

mouth of the Hooghly River and the passage through its tortuous channels to Calcutta, Bombay Harbour, the Island of Ceylon, the Irrawaddy, and other great rivers, might be rendered safe and navigable on all nights by a judiciously studied system of gas-lit buoys.

Many unprotected islands, shoals, and coral-reefs—the cause of so many wrecks, as the recent loss of the P. and O.'s fine steamer "Indus," and a more recent wreck of an English steamer in the Straits of Bab-el-Mandeb, are but a few examples in a thousand—might be distinctly marked, and the small cost of installation and subsequent maintenance would be but a fractional part of the losses occurring to merchants, shippers, and insurance companies from the wrecks, but now too unfortunately frequent. Lloyd's list of wrecks shows an average of about a hundred a day in all parts of the world, a great proportion of which occur at night, or from uncertainty of position, when a well-devised system of self-sustaining lights would prevent many of such disasters.

The Italian Government, which in marine affairs is now certainly one of the Great Powers of Europe, has shown its appreciation of a system of gas-lit buoys by ordering two of Pintsch's buoys for trial at the entrance to Naples, and by also decreeing an experiment with Foster's system at Genoa in the coming spring, after which it is their intention to place a quantity of buoys in the Red Sea to mark the difficult navigation on approaching Massowah, eventually destined to become a great centre of commerce, as the port of export from Abyssinia and Central Africa.

All Governments are notoriously slow in dealing with new inventions, but the favourable results shown in the United States by the Foster buoys and beacons, and the many awards of competent juries, place this system on an exceptional footing.

I wish it distinctly understood that I do not claim for Mr. Foster the first idea of filling buoys with gas, for as far as most careful investigation of the records show no one prior to Mr. Julius Pintsch, of Berlin, in 1876, ever suggested gas-lit floating lights.

The Trinity House Board have used Pintsch's gas-buoys for some years, but intend experimenting with Foster's buoy, which is entirely novel in construction and contains gas compressed to 40 or 50 atmospheres, while eight is the pressure of Pintsch's buoys.

While convinced of the great advantage to be obtained by a judicious and extended use of gas-buoys, there is still a large field for improved light-towers made of tubes containing compressed gas—thus serving a twofold purpose—to mark headlands and shallow waters, in many parts of the British Empire, and in savage countries where a staff of attendants is impossible, or where, as sometimes occurs on desert islands and the coasts of Africa, there is neither food nor water to be obtained. The respect and awe of savages for a light burning day and night with no visible source of supply, would ensure the safety of such a light in countries where the establishment of a light-station might be dangerous.

There is no limit to the size of these light-towers, and their term of

service when charged could be arranged from one month to one year without refilling, according to strength of light required.

Useful lights giving 200 candle-power naked light or 1,000 candles with optical apparatus, visible 15 to 20 miles in clear weather and consuming $6\frac{1}{4}$ feet an hour, with occultations of 15 seconds each minute, would burn from 10 months to a year.

The manner of supplying detached lighthouses and gas-buoys by a tender on which the gas may be generated and compressed into the reservoirs, is shown by the illustration on the wall.

The device of a bent gas-tube to supplant rubber hose, which burst under the great pressure adopted in the Foster system, is due to Mr. Scott, an assistant light-keeper in Currituck Sound, North Carolina, where ten beacons have been in service since 1880.

With these preliminary remarks as to the utility of the system of compressed gas, I now propose describing in detail certain portions of Foster's Compressed Gas as applied to beacon lights, signals, and buoys.

Rapid advances in the arts and sciences have led to numerous valuable improvements in nearly all branches of industry, but none are more important in their peculiar province than the use of gas for lighting beacons and buoys as applied to the system described in this paper. Practical demonstration has proved that the advantages attending the use of this luminant in preference to oil are as marked when adapted to the lighthouse service as in domestic use, and when to this superiority is added wonderful economy in cost of maintenance, and far greater reliability under trying circumstances, further argument in favour of its general adoption seems unnecessary, though a comprehensive summary of cause and effect is not out of place in this connection, in order that a thoroughly intelligent understanding may be reached.

To render the use of gas available for this purpose it is necessary to compress an immense volume of the fluid into the smallest possible space and to provide a receptacle for its storage, with sufficient capacity to supply a light for an extended period capable of being readily refilled; that shall be as nearly indestructible as possible, and when once charged, the arrangements for its consumption so perfect as to render the light reliable, and independent of supervision until the gas is exhausted.

The economy obtained by petroleum gas over petroleum oil may be demonstrated from Mr. Wooten's report, as General Manager of the Reading Railroad, to the Directors, by which we learn that the saving effected in about two years was sufficient to cover the whole outlay expended on the outfit, a sum of 5,097*l.* sterling. This too in a country abounding in petroleum. The saving of labour in cleaning and trimming the lamps is also a not inconsiderable item when on a large scale.

The distinguishing merits of the Foster system are :—

First.—In an apparatus producing from a most available, plenteous, and low-priced material, a perfectly "fixed gas" of intense illuminating power, which deteriorates neither when subjected to low temperatures nor any degree of compression.

This is of the greatest importance in using compressed gas in the lighthouse service, for the volume which must be stored is in minor proportion to the illuminating power of the gas; 1,000 cubic feet of this gas will give as much light as 200 lbs. of sperm candles, about five times as intense as coal-gas.

Second.—In a compressor equally free from complication and so thoroughly effective, that 3,500 lbs. to the square inch has been attained by it; in this particular lies one of the most prominent merits of the Foster system; for it will be apparent that the advantages to be derived from the use of compressed gas will be increased with the degree of pressure, and the consequent reduction of volume.

This is specially true of the use of compressed gas for lighting beacons and buoys, when the principal object to be attained is to put the largest quantity into the smallest space, in order to reduce the size and cost of storage tank to a point admitting the use of gas pipes or tubes for receptacles, instead of reservoirs made of large plates, riveted or welded together, which are liable to injury from any violent contact, are costly to repair even when it is possible so to do, and with which there is no assurance that they will not become useless at a time when their absence or condition would be fatal to the interests or lives for which they are supposed to afford protection.

The Third prominent feature of the Foster system is the automatic appliance for regulating the flow of gas to the burner, without which the enormous pressure operated by this system would be valueless.

When it is understood that the pressure per square inch in a tank containing forty atmospheres of gas is equal to a column of water about 16,000 inches in height, and that the pressure of gas at the point of consumption should be equal to a column of water seven-tenths of an inch, while the gas in the supply tank is being consumed and the pressure diminished down to the last inch, it will be understood how important is the office of the governor.

This invention, the result of many years of study and costly experiment, is the only *perfect* appliance of the kind yet devised.

The cheapest, safest, and best system of lighting is with petroleum-gas. Its production costs less than coal-gas, is much more luminous, and when properly made, is susceptible to great compression, without material deterioration. The expense of manufacturing gas under the Foster system is equal (lighting power considered) to about one-tenth the average selling price of coal-gas, and in estimating the probable saving by its use it is safe to calculate on this basis. The cost of lighting by this system, as compared with high test mineral oil, is about 40 per cent. less.

Complete works for manufacturing and compressing the gas cost from 1,000*l.* to 3,000*l.*, according to capacity and local conditions. The principal object of compressing gas is to contract its volume to the smallest possible space, in order to carry a long period of supply in receptacles of convenient size, hence it will be apparent that the advantages to be derived from any compressed gas system will be increased in proportion to the degree of pressure operated, and the consequent reduction in volume; in other words, *that system is the best*

TABLE C.—Comparative Cost of Luminants.

| Order of light. | Candle-power U.S. Light-house Standard. | Consumption of oil per annum. | | Consumption of gas per annum. | | Comparative cost of luminants per annum. | | | | Percentage increase in cost of oil over the Foster system. |
|-----------------|---|-------------------------------|--------------------|---------------------------------------|--|--|----------------------------------|---------------------------------------|--|--|
| | | Mineral oil. Gallons. | Lard oil. Gallons. | Coal gas 14 candle-power. Cubic feet. | Petroleum gas (Foster system). Cubic feet. | Mineral oil at 18 cents per gallon. | Lard oil at 90 cents per gallon. | Coal gas at \$2.00 per thousand feet. | Petroleum gas (Foster system) at \$1.00 per thousand feet. | |
| First | 400 | .. | 938 | 625,988 | 125,193 | .. | \$844 20 | \$1,251 93 | \$125 19 | 574 per cent. |
| Second | 164 | .. | 560 | 255,762 | 51,152 | .. | 504 00 | 511 52 | 51 15 | 885 " |
| Third | 78 | 270 | .. | 120,312 | 24,062 | \$48 60 | .. | 240 62 | 24 06 | 100 " |
| Fourth | 32 | 137 | .. | 50,000 | 10,000 | 24 66 | .. | 100 00 | 10 00 | 146 " |
| Fifth | 18 | 86 | .. | 27,955 | 5,590 | 15 44 | .. | 55 91 | 5 60 | 175 " |
| Sixth | 12.5 | 40 | .. | 18,765 | 3,753 | 7 20 | .. | 37 53 | 3 75 | 92 " |
| Light-vessel. | 18 to each lamp | 16 lamps 1,088 | .. | not practicable | 89,120 | 195 84 | .. | .. | 89 12 | 117 " |
| Buoys | 10.5* | .. | .. | not practicable | 7,324 | .. | .. | .. | 7 32 | .. |

* The buoy light may be increased to the intensity of 50 candles, when necessary.

which produces an equal light for the longest period from a given sized cylinder.

The Foster system as satisfactorily operates forty atmospheres of pressure as others do eight atmospheres, reducing the gas cylinder to one-fifth the size; or, with the same cylinder capacity, giving an equal light five times as long as any other; this is accomplished to such an extent by the Foster apparatus, that receptacles holding the gas under pressure are made of lap-welded tubes, 15 inches in diameter, having heads welded in each end, instead of being made of large plates rivetted together, which, besides being unreliable, are heavy, cumbersome, and expensive.

The cost of operating the Foster system as shown by the foregoing table, is based upon the standard intensity of light and number of hours of service adopted by the United States Lighthouse Department in burning oil, which in all cases necessitates the employment of keepers. The large saving shown is but a small percentage of the actual reduction in cost of maintenance under this system. At stations operating fog-signals and revolving machinery where keepers are absolutely required, the force can be largely decreased. Proper attention to oil lights involves the cleansing of lamps and chimneys, trimming wicks, care and measurement of oil, lighting and adjustment of flame, and almost constant watching while lighted.

The operation of the compressed gas system involves no more care than a simple gas burner in a private house. The governor once regulated, only the required gas can pass to the burner, insuring an unvarying flame until the supply is cut off or exhausted. Fixed lights of the fourth, fifth, and sixth order, having no machinery, or where it is possible to introduce our automatic appliances, and which are accessible by a tender, require no keeper under the Foster system, and the saving thus effected would, in many instances, repay the entire cost of apparatus in from one to two years.

Under such circumstances the lights necessarily have to burn continuously (as is the case with our beacons in Currituck Sound), and an increased consumption of gas results, costing as follows:—

| | | | |
|--|----|------|------------|
| For a fourth order light, about | £4 | 12s. | per annum. |
| " fifth " " | £2 | 13s. | " |
| " sixth " " | £1 | 17s. | " |

Where gas is to be supplied to buoys, or to lights placed on permanent structures, it is advisable and most economical to place the generating and compressing apparatus on a "tender," specially designed for the purpose; and as it would only be necessary for the "gas tender" to visit the stations once in six or twelve months, according as provision is made, it would be capable of supplying hundreds of lights. Oil and fuel for one round trip to all the lights could be taken on board at points affording the cheapest market. Proper provision for the storage of oil in suitable tanks instead of in barrels reduces its cost, and by this means the "gas tender" could supply stationary works located at buoy depôts with petroleum.

By this system, compression of the gas may follow immediately

upon its generation, and in such case it is forced at once into the storage tanks provided, the entire proceeding being carried on, regardless of the vessel being at rest or in motion. From ten minutes to one hour, dependent upon the capacity of the beacon-tanks or buoys, would be expended in charging, and if the lights were not very close together, sufficient gas would be generated in the intervals between stoppages at stations to immediately supply the receptacle when reached.

An infrequent visit, possibly not oftener than once in three or six months, to cleanse the lens, which can be done by a resident of the neighbourhood or by a passing tender, will be all the attention required under this system, after the reservoirs have been charged for a stated period, six or twelve months. The absolute necessity for the increase of lights and signals on our waters is well understood, and forcibly illustrated by the almost daily records of destruction to life and property in connection with transportation by vessels, and the intelligence of the age insists upon the adoption of the most perfect, reliable, and economical appliances to the attainment of this result.

DETAILED DESCRIPTION OF THE FOSTER APPARATUS.

The Gas Works.

The cheapness of petroleum and the ease with which it can be vaporized, or converted into a gaseous form, have led to many attempts to use it for the production of illuminating gas. Although some measure of success has attended even the rudest efforts of this kind, yet the great difficulty has been to produce a *fixed gas*, or one which would not smoke nor condense and thus deposit tar and other obstructions in the apparatus used, nor lose its luminosity when subjected to low temperature or great compression, and at the same time keep the latter so simple that a person of ordinary intelligence could manage it.

To those who are not familiar with the process of converting petroleum into gas it may be said that if in the process of conversion too low a degree of heat be used, some portions of the gas produced will be readily condensed, and the gas thus lose its luminosity and form a deposit of coal-tar and other substances in the apparatus. In other words, a certain high degree of heat must be employed to make the gas non-condensable under the ordinary circumstances of its use. On the other hand, if the temperature be too high, the carbon in the petroleum will be deposited in the retorts in a solid form, thus leading speedily to their destruction. Success in the production of petroleum gas is therefore dependent on the regulation of the temperature during the process of gasification. This is difficult to do, for the reason that if liquid petroleum be injected into a hot retort and converted into gas it will absorb an enormous amount of heat in the process of changing from the liquid to a gaseous state. This principle is illustrated in the boiling of water. Under atmospheric pressure water boils at 212° , and the temperature of steam at the same pres-

sure is also 212° . It is, therefore, often thought that to convert water into steam under those conditions all that is required is to heat it to that temperature. But when this has been done we have simply water boiling hot. To convert it into steam we must continue to add more heat, which in the old phraseology was said to become "latent." The *quantity* of heat contained in a pound of boiling water is 212 units, whereas a pound of steam of atmospheric pressure has 1,178.1 units. In other words, the amount of heat required to convert a pound of boiling water into steam is $1,178.1 - 212 = 966.1$ units, which has been called "the heat of gasification." The conversion of petroleum, or any other substance, into gas, is attended with exactly similar phenomena, that is, an enormous amount of heat is absorbed in gasifying it. To maintain the requisite temperature in the retorts, therefore, they must be heated very hot, which either produces a deposit of solid carbon in the inside, thus impairing their efficiency, or they are rapidly destroyed by the great heat. On the other hand, as already explained, if the retorts be not kept hot enough the product will not be a fixed gas, but will condense and deposit tar in the apparatus.

In this dilemma the resort has usually been to the use of retorts at so low a heat as to be incapable of making a fixed gas, and to use a quantity of air or non-luminous gas to carry the imperfect products to the place of consumption—a practice resulting in great waste, and, although the effect of a very small quantity of air in very rich gas may not be noticed, the admixture of large quantities rapidly destroys the lighting power. So great is this destruction that 1,000 feet of oil-gas which is capable of giving as much light as 200 lbs. of sperm candles, when mixed with 1,000 feet of air, forming 2,000 feet of so-called "mixed gas," will give only as much light as 100 lbs. of sperm. This is of great importance if gas must be compressed and stored in a portable holder, as it must be for beacons and buoys, for the volume which must be stored is in inverse proportion to the illuminating power of the gas.

In the manufacture of petroleum gas, then, the temperature should be regulated so that it will not be high enough to destroy the retorts rapidly, or cause the carbon in them to solidify, and yet the heat should be sufficient to produce a fixed gas with a high illuminating power.

While this process is not confined in its use to the manufacture of gas for illuminating beacons and buoys alone, yet it has the advantage of producing gas of higher illuminating power which does not lose luminosity when compressed, and which will not deposit any tarry or liquid substances in the process of manufacture.

The Foster Compound Gas Compressor.

Two great difficulties attend the compression of gas or air, especially under a high pressure. These are:—

First. The development of "latent" into sensible heat, which necessarily results from compression. In other words, the tempe-

perature of gas is elevated by compressing it, consequently there is a diminution of volume when the fluid afterwards becomes cool.

Second. The loss of effect following an imperfect displacement of all the gas from the pump cylinder at each stroke, which results in a re-expansion of the gas left in the cylinder, thus partly filling it with gas that has once been compressed instead of taking a cylinder full of *fresh* gas at each upward stroke of the piston. Various attempts have been made to overcome these difficulties, but with only partial success, so that generally it has been concluded that it is better to use comparatively low pressure than to encounter the difficulties referred to.

In order to be able to attain a high degree of compression, Mr. Foster has adopted what is known as the compound principle in the gas compressor. The result is so successful that 3,500 lbs. pressure to the square inch has been obtained, as has been previously stated in this paper.

The Foster Gas-lighted Buoys.

The Foster buoy is composed of a group of 7 or 13 lap-welded cylinders, made without seams or rivets, each cylinder forming in itself an independent water-tight compartment, capable of withstanding heavy concussion from floating bodies such as would prove fatal to those constructed of the large plates now used in other gas-buoys. These cylinders, like those employed in our beacons, are capable of being charged with gas compressed to from 40 to 50 atmospheres, and the supply is sufficient for six or twelve months, according to size and number of gas cylinders. Its subdivision of receptacles gives assurance of buoyancy, even should one or more cylinders receive injury of a character which would cause inevitable loss, by sinking, of any other buoy having but one or two compartments. Each cylinder having an independent check-valve prevents the escape of gas from the other tanks, should any of them be injured.

To practically exhibit the workings of the Foster buoy, one of the structures was on July 1st, 1882, placed in the Delaware River, where it remained burning continuously until October 1st, when, by authority of the United States Lighthouse Board, it was moored near the Fourteen Foot Bank Light Vessel, in Delaware Bay, a most exposed position, and it there remained until November 15th, 1882, when the gas became exhausted. Another experimental buoy was carried down the Delaware River from its moorings in a strong flood, and after a period of several days was found aground in Delaware Bay, with its light still burning, notwithstanding the shocks and knocking about it had received.

The Foster Gas Lighters Beacon and Automatic Fog Signal and Flash Light.

The beacons were first adopted by the United States Lighthouse Department in the latter part of 1880, when ten were erected for lighting the waters of Currituck Sound, N.C. and Va.

Since their introduction numerous and valuable improvements have been made by the patentee, the most novel of which is an automatic fog bell and flash light attachment. The power for operating the machinery is furnished by the rise and fall of the tide acting upon a float inclosed within a water-tight caisson, to which water is admitted in given quantities, and provision is made for the continued operation of the apparatus during "slack water," except for a period of a few minutes.

In this device the light flashes simultaneously with each stroke of the bell, thus enabling the navigator to determine his exact position by timing the interval between the flash and sound signals.

This structure is particularly adapted for marking shoal and dangerous places, and entrances to harbours and rivers, and will operate successfully when there is a rise and fall of 5 feet or over; it may also be erected on shore when pipe connection with low water is admissible.

The Use of Compressed Gas in Naval Warfare for Torpedo and Submarine Boats.

Gas made from petroleum is capable of great compression, and with Foster's compressor as much as 3,500 lbs. to the square inch have been obtained (about 230 atmospheres).

Compressed hydrocarbon can be contained in a very small space for the service it performs. There is absolutely no waste attached to its use. Under proper regulation entire combustion takes place, and consequently there is an absence from smoke, so serious a drawback to all coal-fuel.

With coal we have besides 90 per cent. of loss in solid substance, which is utterly useless, occupies valuable space, and subsequently has to be thrown overboard, entailing much time and labour.

By means of the steam generators which I employ I am enabled to obtain a high efficiency with small boilers or apparatus.

So quickly is water converted into steam that the boilers can make 200 lbs. of steam pressure, while only containing a few gallons of water at a time, therefore even if a coil burst, the damage would be slight.

The water is heated in stages by being split up into thin streams by passing it through spiral or helical coils of pipes, themselves constituting a boiler, or in combination with an annular boiler, formed by placing one dome-shaped shell within another, that would by itself constitute a boiler. Heat is applied by the use of compressed gas passing through atmospheric or other burners, so arranged that the greatest amount of heat may be generated by the combustion of the gas either with air or oxygen, and transmitted in the most efficient manner to the pipes through which water or steam is flowing.

The products of combustion are then collected, and either escape in the usual way or are forced by pressure through an escape valve, combustion in some cases taking place under the influence of a compressed atmosphere.

The advantages I claim for gas over any other substance are its freedom from smoke when properly regulated, its instantaneous ignition and equally instantaneous extinction, its perfect combustion, facility of manufacture, and satisfactory service.

The requisites for torpedo-boats, and especially submarine boats, to render them efficient are great speed, compactness, quick manœuvring, and certainty of action. All machinery is liable to fail, and the power which supplies machinery may equally become exhausted at a critical moment. In any submarine boats when coal is used a certain period must elapse after ignition of the fires has occurred before they can be in full service. With gas we get up steam in a few seconds, either below or above water.

The little American boat "Stiletto," that made 29 miles in 1 hour and 17 minutes, on a gallon of water in a beehive coil boiler, is an example of this principle.

Petroleum is stored in tanks, and can be made much more effective than coal, as its bulk is not wasted. These tanks should be on the supply tender.

I should propose that when a fleet of submarine boats were employed, a tender provided with gas generating apparatus and compressor be used to supply compressed gas to the torpedo-boats. But as this service would probably be more particularly confined to the protection of harbours and estuaries, provision for gas stations is easily made.

An idea has lately been protected for raising steam by the aid of Foster's compressed gas as fuel, with a view of substituting it in the place of coal, more especially when storage dimensions are limited, and when the area of boiler space has to be reduced to a minimum, and it is at present under consideration whether this system may not be advantageously adopted as a motive power for the propulsion of submarine boats. Its primary recommendation is that we can stow sufficient compressed gas in such a vessel capable of providing fuel for a much longer period than will be necessary to remain in action.

Secondly, its storage being of course in sealed cylinders, it is a matter worth consideration that these cylinders can be placed within the space reserved for the reception of water required for sinking purposes, allowing of course for a certain amount of increased space being required in that compartment due to the area of the gas tubes, so that by raising the deck over the water space a few inches, a clear way from fore to aft will be secured for the reception of whatever machinery may be called into requirement.

As of course boiler space is a matter of serious moment in these vessels, it is necessary to provide those which shall have the greatest amount of heating surface combined with the most effective circulating powers, and I am of opinion that a boiler constructed almost entirely of spiral tubes, as previously described, through which water would be caused to circulate freely, owing to the rapidity with which the small quantity of water in the boiler at one time would be raised to steam by the use of suitable burners through which compressed gas

could be supplied at variable pressures, will be a preferable means for obtaining the motive power to that where coal firing is used.

Roughly speaking, without having the particulars of any experiments, and upon the supposition that gas is used from a storage compressed to 50 atmospheres, it is computed that steam will be raised to a sufficient pressure for propelling a boat not less than 60 feet long in a boiler, the dimensions of which shall not exceed 6 feet diameter at its base, and of a height not exceeding its diameter, and that fuel for seven hours firing could be carried in every 50 feet length of cylinders 15 inches in diameter.

We are all cognizant of the usefulness of steam as an agent to be relied upon, and I am strongly impressed with the idea that for purposes where there must not be a suspicion of possible failure, engine power is the only method worthy of consideration.

Colonel J. B. RICHARDSON, R.A. : I should like to ask how the greater absorption of light is accounted for, whether light of one colour is more apt to be absorbed than light of another colour, whether experiments in different lights have been tried with reference to absorption. I should also like to ask whether these cylinders containing gas under very great pressure—a great number of atmospheres—could be used in the Red Sea as is suggested, or whether the great heat of the sun in that sea and in the tropics would not tend to burst them. We are told in the lecture that it has only been tried in New York, and that it is not capable of being damaged by cold. The question of the effects of heat has not apparently been taken into consideration.

Captain CURTIS : I should like to make one remark with respect to the buoy that is exhibited. It is apparent to every seaman that where there are no highlands or high objects serving as landmarks in approaching a river, those buoys have great advantages over the ordinary kind. I should like to know if 45 atmospheres is the utmost limit to which the gas can be compressed, because I have an idea that it might be utilized on rivers in our pleasure yachts.

Mr. RICKMAN : Shall I be in order in asking if the lecturer is aware of a report made by Admiral Rowan, Chairman of the Lighthouse Board of the United States, to the Secretary of the Treasury, dated 16th February, 1883 ; and also whether he is aware of a report made by the Experimental Committee of the Lighthouse Board of the United States to Admiral Rowan, this report being dated April 23rd, 1884 ?

The CHAIRMAN : I would also like to ask Mr. Huntington to give us the cost of the gas so much per thousand feet.

Mr. INGLIS (Secretary to the Trinity House, Tower Hill) : I should like to make an observation or two upon this paper. The Trinity House, as you know, Mr. Chairman, are very much interested in anything approaching to an improvement in lighthouse work, and they will, I have no doubt, have very great pleasure in inquiring into the details of the scheme which Mr. Huntington has put before us. There are, of course, many questions to be asked with regard to the details of such a scheme, but it appears to me, in the first instance, that if he is hopeful of attaining such high powers as are mentioned in the Report of the Committee on Lighthouse Illuminants, he does not fully realize what quantities of gas he will require. Now we have here a 10-ring gas-burner consuming more than 200 feet per hour, and it is the work done by such a burner as that which is dealt with in the Report from which he is quoting. We have here again a 6-wick oil burner, of the type in common use in lighthouses round the coast, consuming paraffin or rape oil. To produce a light of that power we should need a very much more extensive system of supply for gas than is indicated in the paper ; and it would be unsafe to assume that by the process described we should be able to secure lights of high power without the attendance of keepers. Nor could we supply them with compressed gas except at an expense enormously greater than that which we are called upon to meet in using oil or gas in the ordinary way. I think that the flame produced in

the burners of the Metropolitan Railway carriages, and which is spoken of rather slightly in the course of the paper, is very much nearer the illuminating power that we shall have at our command by means of the compressed gas system, at all events for some time to come, such a light as we have in a lantern of this kind which is taken off the top of an actual gas-lighted buoy. Consequently, the quotation of those very large powers I think raises hopes that are not likely to be realized. The gas that we have used in gas-buoys at present is distilled from shale or mineral oil, and produces a high illuminating power, in fact with the Douglass burner it was made to beat the cannel gas at an experiment at South Foreland, that is to say, it gave a higher illuminating power in the same burner. Another question to be asked is whether the travelling and floating gas works spoken of have yet been brought into action. The lecturer speaks of making and compressing gas as you go along, and of putting it into buoys or landing it into beacons; but I should like to ask, has it yet practically been done? We find that a buoy, lying of course in more or less disturbed water according to the state of the weather, has to be filled with gas by attaching one end of a flexible pipe to the receiver on board the vessel, which receiver is charged with gas to about 20 atmospheres, and the other end to the buoy brought alongside. The gas, passing from the receiver through the tube, rushes into the buoy until the pressure in each is nearly equal, so that we get, perhaps, 10 atmospheres left in the receiver on deck, and 10 atmospheres in the buoy afloat. If the buoy is to be served afloat in this way, the anticipation that we shall be able to make our gas and to compress it direct into the buoy is rather sanguine. If we might hope always to lift the buoy on deck, the process would perhaps be easier; but serving it as we do now, I am afraid we shall not be able to get the pressure spoken of, and consequently shall not attain the long duration of un replenished service which is anticipated for the buoy. As regards the floating structure shown in the drawing, I am not an engineer, and cannot speak with authority, but I am a little afraid that the mode of mooring will be found inconvenient, if not disastrous. We had an automatic buoy with a long tube reaching down far below it into the water, moored in that way in the first instance, and the chafing of the mooring round the part where it was attached was so great that the buoy got nearly waterlogged. In the absence of diagrams, of course we cannot see the process of making the gas. It would have been very instructive to have seen it; of course we shall learn more when the paper is published. One other remark I would make is that the buoy that is said to have come down the Delaware River in the ice without losing its light was a very fortunate buoy. I think it is probable that it was not so much knocked about as at first sight would appear, because one rather important difficulty we have had to overcome is the effect of a blow upon the buoy. A barge running against a buoy in the Thames, or even a boathook struck against it, has been known to put the light out; and that buoy at Sheerness was in the early stages of the experiment put out by the concussion occasioned by the firing of heavy guns. These are some of the questions, founded upon difficulties which have been overcome in the present state of the service in England, upon which some further information is desirable on the present occasion.

Admiral BRINE: In the few remarks I propose to offer on this paper I shall confine myself almost entirely to the question of the automatic fog signal. The impression of most Officers who have been in fogs, or in any circumstances where it is important that they should know their position, has been that it is exceedingly difficult to realize where their position is by the sounds they hear, and I propose to ask the lecturer whether he will be able to inform us what experiments have been made in the United States with reference to two points: one, the best method of getting sound carried through a fog to indicate with reasonable accuracy the locality of such sound: and the second, the best method of carrying any illuminating power through a fog. Of course in lighthouses and in the various structures such as we see here illustrating this lecture there are certain things we can control. We can control the gas, or whatever may be the illuminant that is used; we can control the strength and height of the light, but what we cannot do is to be certain that in any given atmospherical conditions you are able to penetrate to the same distance with that light. I believe it has been ascertained by experiments undertaken by the Elder Brethren of the Trinity House that on days apparently precisely the same, and in

fine clear weather, light is extremely different as regards its power of penetration of the atmosphere. I believe in some cases the same light which on one clear night will be seen a certain given number of miles, on another night, apparently to the eye exactly similar, the light is only seen about one-half or one-third of the distance, and I am under the impression that no very clear explanation has been given as to the cause of this variation. As regards sound, the extraordinary fact occurs that at one time you will find that sound signals will travel and reach the ear at a distance not exceeding 3 miles, which is the ordinary reliable distance, and on other occasions the same sound will reach, I am told, as far as 15 or 16 miles under what appear to be precisely similar conditions. It has also been found that in fogs, in which it is generally supposed that sound does not travel well, it actually travels better than it does in fine or clear weather. It has also been ascertained that mist and snow are conditions of the atmosphere which are favourable for the conveyance of sound through the air. I would like the lecturer to tell us if he knows what experiments have been carried out in the United States upon the subject of sound signals. We know what has been done by our Trinity House within the last ten years, and the series of useful investigations that have been made with regard to this important subject.

Colonel BAYLIS: It has just been observed that the mere concussion of firing guns will extinguish the light. I think it was also said that a boat striking against a buoy, or even a boathook striking it, will put out the light. If that be so I should like to ask whether when a violent sea strikes against the buoy and vibrates it considerably, the light is or can be so protected as to ensure its remaining intact?

Mr. HUNTINGTON: A good many questions have been asked me which I am afraid I am unable to reply to, and some reports, which I have not even heard of, have been referred to in one question. I am first asked if there is anything in the colour of the light with reference to absorption. I think it has been understood that in gas and oil flames the red rays carry much further than any other rays, and that the violet tint in the electric light does not carry so far. With reference to the effect that the heat of the sun might have upon the compressed gas in situations such as the Red Sea, I may say that of course these tubes would be made of such strength as to resist any such extra pressure which might be brought to bear upon them. That is a matter which can be easily arranged. As I have said, I regret that I am not acquainted with the report made by Admiral Rowan in 1883, or the report made to him in 1884. Mr. Inglis has very kindly taken part in this discussion, and has asked some questions with regard to having the gas upon the tender. We have not at present had gasworks upon the tender itself, and the way in which the buoys have been supplied has been, as is suggested, that the reservoir has been put into a scow, and being connected with the buoy, the pressure was allowed to equalize. It is just as has been described, except that the pressure in the tanks was much higher than Mr. Inglis stated. The gas has never been generated in the vessel itself. It was only supposed that that would be a good idea for supplying a great number of lights on inland waters, where you have 50 or 100 lights to serve. It might not be required in this country.

Mr. INGLIS: Do I understand you that you have 45 atmospheres in the beacon, or 45 atmospheres divided by 2?

Mr. HUNTINGTON: We get 45 atmospheres in the beacon. The pressure is much greater in the storage tanks, and it is equalized in the pressure. That is the report we had from the Lighthouse Department of the United States authorities. With regard to the buoy coming down the Delaware I may say I omitted the word "ice" in reading my lecture. The circumstance was told to me, but I am convinced that that statement must be incorrect. No doubt it was a strong flood, and the buoy was carried down in that flood, knocked about, and ran aground, but still the light did not go out. I have quotations from the daily papers speaking of the circumstance. I regret that I am not able to give the information that Admiral Brine asks for with regard to the effect of fog upon the transmission of sound. As to the cost of the gas, it would depend upon the price of petroleum. When petroleum is $4\frac{1}{2}$ cents a gallon the gas would come to 19 cents a thousand feet, including everything. That is the cost in America—a little under 1s. a thousand feet. One man can make and compress 10,000 feet of gas in a day. I have seen it working myself, and have seen

one man do it, and I think that compares very favourably with the results obtained at any coal gasworks.

The CHAIRMAN : I am sure we are all very much indebted to Mr. Huntington for the able lecture which he has delivered on a very abstruse subject. Some parts of it were exceedingly deep. I know I felt that the tide had risen clean over my head. But there are some practical portions of this subject that one can grasp. Moreover, all these scientific matters have to bear the test of practical experiment, and of long-continued experiment. I speak mainly of the light he gets from the gas. The lighthouse authorities always experiment thoroughly upon any illuminant that may be proposed to be used for our lighthouses and lightships round the coast, in order that they may be able to rely upon the work which that illuminant can do. In this connection it may be interesting to gentlemen to examine these burners which are on the table. One is for oil with six concentric wicks. It is the burner which is in common use all round our coasts, and it produces a splendid light, so powerful that in clear weather we only use the three outer wicks. When the weather becomes misty we light up all six, and so we get a very powerful light. Then, we have this still more powerful gas-burner with ten concentric rings of gas. The six-wick oil-burner has been in common use for many years round our coasts. It shows a light equal to about 720 candles, and we can keep it going at an expenditure of half a gallon an hour, costing only about 3*d*. This is the consumption in foggy weather ; it is not above one-half or two-thirds of that in clear weather, when only half the wicks are burning. The oil is very easily conveyed to our lighthouses and lightships.

Admiral FREMANTLE : What sort of oil do you use ?

The CHAIRMAN : Paraffin oil, distilled from Scotch shale. From a long-continued set of experiments which we have made at the South Foreland we find, as far as we can arrive at the cost, that we produce a light of 1,000 candles from paraffin oil (such as we use), and allowing for all expenses the cost would be about 10*d*. per 1,000 candles of light per hour. If we were to use gas produced from cannel coal it would cost us just double that, or 20*d*. an hour, and Mr. Pintsch's oil-gas comes to something between the two. I am sure that nothing under a series of exhaustive experiments will convince me that the gas which Mr. Huntington has told us of can be produced at such a very low figure as he supposes. If we add to its original cost the expense of conveying it to or making it at out-of-the-way stations where our lighthouses are placed, it would come to something very much higher, and I think very much beyond the cost of the oil which we now burn. Of course the oil produces ample light ; quite as strong as is necessary. We have in one lighthouse two of these oil lamps, one above the other—the biform system. We light the second burner in foggy weather, and at a distance beyond a mile and a half it seems like one great light. There are other systems of lighting, with three or four lamps superposed, so that it is easy to produce as powerful a light as is at all necessary. I will not occupy your time any further ; but I hope I may, in your names, thank Mr. Huntington for his very interesting lecture.

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OCCASIONAL PAPER.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE GERMAN ARMY IN 1886.¹

By Major J. S. ROTHWELL, R.A., Professor of Military Administration, Staff College.

- Section I. Organization.
- „ II. Infantry.
- „ III. Cavalry.
- „ IV. Artillery.
- „ V. Pioneers and Railway Troops.
- „ VI. Train and Departments.
- „ VII. Recruiting.
- „ VIII. Mobilization.
- „ IX. The Army on a War Footing.
- „ X. Clothing, Equipment, and Arms.
- „ XI. Officers.
- „ XII. Military Discipline.

I.—ORGANIZATION OF THE GERMAN ARMY.

By most readers of the Journal of the Royal United Service Institution it will be admitted that the German Army of the present day, though not the largest of the Continental forces, is that which is most completely organized, and consequently most efficient. Before proceeding to an examination of the details of the German military organization, it will therefore be of interest to enquire as to the cause of this pre-eminence of the German Army, as a fighting machine, over the armies maintained by other Great Powers.

It is clear that the cause is not to be found in any special combativeness inherent in the German, whom we are accustomed to regard as stolid and peace-loving, and whose philosophical temperament is less suited, apparently,

¹ The following works have been consulted in the preparation of this paper:—“The Armed Strength of the German Empire,” Official, London, 1876; Baron Kaulbars’ “Report on the German Army,” Paris, 1880; Baron Stoffel’s “Military Reports,” Translation, Official, London, 1872; “L’Armée Allemande sur le pied de Guerre,” Chef de Bataillon Rivière, Paris, 1884; Deutschland’s “Streitkräfte,” Vienna, 1882; “La Revue Militaire de l’Étranger,” and other periodicals.

for the desperate ventures of the battle-field, than the impetuous disposition of the Italian or the Frenchman. In modern war, however, the result is less often decided by some exceptional feat of arms than by the perfection of the arrangements which enable a leader to count upon his troops being in a thoroughly efficient state at a certain place by a certain time, and it is in the painstaking accuracy by which such results are ensured that the German peculiarly excels. But the German soldier is more than a part of a great machine which works with astonishing exactness. He is intelligent and highly educated,¹ and has moreover an imaginative side to his character, which enables him at the call of duty to perform deeds of heroism equal to any that are recorded in military annals, for the sake of that Fatherland which he regards with an almost romantic affection.

Such is the material of which the German Army is made, and on the utilization of this material it will be seen that a surprising amount of sagacity has been brought to bear. In their treatment of military problems the Germans have made but few mistakes, and this must doubtless be attributed to the fact that the Army commands the services of the best talent in the nation. While in most other States the political, diplomatic, or legal career attracts the young men of the highest ability, leaving those of inferior capacity to fill the posts in the Army, it is otherwise in Germany. There the Army, besides being held in higher esteem than any other profession, actually has in its ranks for a time a large number of those who contemplate following some other pursuit, and by the prizes which it holds out can retain the services of a great proportion of the ablest men that the nation can produce.

Development of the German Army.—The German Army of the present day may be considered as a comparatively modern institution; for though it inherits the glorious traditions of the Army of Frederick the Great, its constitution was so radically changed in the early part of this century that for our present purpose it is unnecessary to go back further than the reconstruction which followed the disastrous campaign of 1806–7. Prussia was at this time so completely at the mercy of her conqueror that she was forced to submit to any terms which he was pleased to impose; and by the Paris Convention of 1808 Napoleon decreed that for ten years the standing army to be kept up by Prussia should not exceed 42,000 men of all arms,² and that the militia should not be called out.

At the end of 1808, therefore, we find that Prussia, whose Army at the outbreak of war in 1806 had amounted to about 250,000, had no more than the stipulated number in her ranks, and was thus supposed to have been reduced to impotence. On the collapse of her military power before the armies of Napoleon, a Military Commission had however been at once appointed, and this Commission, which included the best men available, such as Scharnhorst, Gneisenau, and Clausewitz, recommended the adoption of a system by which Napoleon's restrictions were rendered nugatory. The plan decided on by the King, on the advice of these distinguished Officers, was to dismiss to their homes all soldiers who had completed their course of instruction in drill, and replace them at once by recruits, who in their turn were sent back to civil life directly they had become trained soldiers. In this way the Army was neither more nor less than a great military school, and though

¹ Of those who come before the recruiting authorities, only 1·5 per cent. are illiterate.

| | |
|-------------------------------|--------|
| ² Guard..... | 6,000 |
| Infantry (10 regiments) | 22,000 |
| Cavalry (8 regiments) | 8,000 |
| Artillery, Sappers, &c..... | 6,000 |
| | <hr/> |
| | 42,000 |

no more than the authorized 42,000 men were ever at one time in its ranks, it was able to pass out every year some 20,000 well-drilled soldiers, who could be recalled to the colours when the occasion for their employment might arise.

At the beginning of 1813 the Prussian landwehr first received a definite organization, and the military forces of the country were thus increased, nominally, by 109,000 men. The training, or, as it was generally called, the "Krümper" system, had by this time been more than four years at work, so that when hostilities were this year resumed, the regular troops of Prussia were over 130,000 strong, in addition to which there were the 109,000 of the landwehr. Prussia was thus in a very different position from that which Napoleon had intended her to occupy, and as his power was now on the wane, the further development of her military organization was taken in hand even while her armies were in the field.

At the end of the campaign of 1814 no time was lost in giving effect to the improvements which had been decided on, and this year saw the Prussian forces organized on a basis which, with some modifications, is that which exists at the present day. The principle of general obligatory service was accepted, and in order to avoid the expense of keeping a very large number of men under arms in peace-time, each unit was given a comparatively small establishment, to be raised on the outbreak of war to the full strength, by recalling to the ranks those who had been sent on furlough after completing their course of military training. The Army was to consist of three main portions; the standing army, the landwehr, and the landsturm. Of these the standing army was composed of men serving with the colours and those in the reserve; the landwehr of two sections, called the 1st and 2nd bans, all the members of which had already served in the standing army; while the landsturm embraced all men capable of bearing arms who were not actually enrolled in either the standing army or the landwehr. The obligation to military service extended from a man's 17th to his 49th year, so that every individual in the nation capable of bearing arms was during this portion of his life enrolled in one of the three portions of the Army.

Under ordinary circumstances a man served in the standing army from his 20th to his 25th year, the first 3 being with the colours and the 2 latter in the reserve. He then passed into the first ban of the landwehr for 7 years, and on leaving this at 32 years of age joined the second ban for another 7 years, after which, being now 39, he became a member of the landsturm for 10 years. Before joining the colours, however, he had become liable to service in the landsturm on attaining the age of 17 years, and if from any cause a man did not join the standing army and complete the regular course of service in it and the landwehr, he still remained a member of the landsturm until he reached the age of 49, when his military liability ceased.

By the Law of 1814, the number of young men who were to join the Army each year was fixed at 40,000, but as the population of Prussia increased, it became necessary to call up a larger number each year, in order to carry out the original idea that the bulk of the young men attaining the military age should pass through the ranks of the Army. This, change, however was not effected in proportion as the population increased, but the yearly contingent remained at the former figure till 1860, when a Bill was introduced by which the contingent was to be raised to 60,000 men, and important changes in the organization of the Army were proposed. By this measure, which became law some years later in spite of serious opposition, the time of service in the standing army and reserve was increased from five years to seven, and the fourteen years in the landwehr were reduced to twelve, five in the first ban, and seven in the second.

With certain modifications this is the system in force in Germany at the

present day, and it is instructive to note that only one important measure of army reform has been introduced in Prussia in seventy-two years. The stability thus given to the military institutions of the country has had an important effect, and has enabled the German soldier to feel assured that a change in his position will not be lightly made, and that his old traditions will not be subjected to rash interference.

During the fifty years which followed the peace of 1815, France still posed before the world as the great military nation of Europe, and while the somewhat slow and methodical manœuvres of the German were sneered at as being antiquated and out of keeping with modern military science, the numerical strength of the Prussian Army was not so great as to suggest the possibility of its being able to hold its own against the larger forces of the other great military Powers. The results of the war with Austria in 1866, however, convinced all who were capable of forming a just judgment that the Prussian Army was something very different from the stiff, barrack-yard, military machine which it had been the fashion to consider it, and that its success, instead of being explained away by the superiority of the needle-gun, was really attributable to the perfection of its organization, and the care taken in peace-time to fit all branches of the Service for the parts which they would have to play in war.

The most important change in organization which followed the war of 1866 was that relating to the landwehr, service in which was now made to terminate at the end of the five years formerly passed in the first ban, instead of extending over twelve years as had been the case under the system established in 1860. The conclusion of the war with France brought with it no alteration in the conditions of service, which have now remained unaltered for nearly twenty years, and are in all important particulars based on the report of the Military Commission which was assembled in 1808.

The conditions under which German subjects perform their military service to the State having been thus set forth, we may turn to the broader question of the organization of the Army as a whole. The principle which has been adopted is that which we know by the name of localization; that is, the maintenance of a definite connection between a certain province or district and a corresponding portion of the Army. In our Service this system of localization has only been applied to the comparatively small units of infantry regiments and Divisions of artillery, but in Germany every military unit, up to and including the Army Corps, has a corresponding locality with which it is indissolubly connected.

Army Corps Organization.—Each of the larger provinces or kingdoms of which the German Empire is now composed has thus its own Corps, but all are similarly armed, equipped, and organized, and are equally under the control of the Emperor. The Corps which formed the Prussian Army in the earlier part of the present century were as follows:—

Guard.¹—I Corps, Prussia; II Corps, Pomerania; III Corps, Brandenburg; IV Corps, Saxony; V Corps, Posen and Silesia; VI Corps, Silesia; VII Corps, Westphalia and Rhine Provinces; VIII, Rhine Provinces.

These military divisions have remained practically the same up to the present time, but after the war of 1866, when Prussia replaced Austria as the head of the German Confederation, three additional corps were enrolled in the Prussian Army, and numbered IX, X, and XI. These corps were furnished by the new provinces annexed by Prussia after that war, viz.:—Sleswig-Holstein, Hanover, Nassau, and Hesse-Cassel, and a Division, which has never been incorporated in any Army Corps, was also added to the Prussian Army, by absorbing the troops of the Grand Duchy of Hesse. The

¹ The Guard has never had a special district.

German Army then consisted of twelve complete Army Corps and an independent Division, but before the outbreak of the war with France in 1870 it was further increased by the Saxon Army, which became the XIIth Army Corps. The troops of Wurtemberg and Baden which took part in the war against France now form the XIIth and XIVth Corps, and Alsace and Lorraine, which were annexed to the German Empire after that war, are garrisoned by the XVth Corps, which is formed of units of infantry and cavalry detached from all other Corps except the Guard. These sixteen corps, with the Hessian Division, are supplemented by the two corps maintained by the kingdom of Bavaria, which though organized on the same principles as the other corps, are not put on the same numerical list, but remain the Ist and IIInd Bavarian Corps. The following table gives the German Army Corps as they stand at the present time :—

| Army Corps. | Province. | Head-quarters. | Commander. |
|------------------|----------------------------------|----------------|---|
| Guard | .. | Berlin | General von Pape. |
| I | Prussia | Königsberg | Lieut.-Gen. von Kleist. |
| II | Pomerania | Stettin | General von Dannenberg. |
| III | Brandenburg ... | Berlin | Lieut.-Gen. Count von Wartensleben. |
| IV | Saxony | Magdeburg | General Count von Blumenthal. |
| V | Posen | Posen | General von Stiehle. |
| VI | Silesia | Breslau ... | Lieut.-Gen. von Wichmann. |
| VII | Westphalia | Münster ... | General von Witzendorff. ¹ |
| VIII | Rhenish | Coblenz ... | Lieut.-Gen. Baron von Loë. |
| IX | Sleswig-Holstein . | Altona | General von Tresckow. |
| X | Hanover | Hanover .. | Gen. Prince Albert of Prussia. ¹ |
| XI | Hesse-Cassel | Cassel | Gen. Baron von Schlotheim. ¹ |
| XII | Saxony | Dresden ... | Gen. Prince George of Saxony. |
| XIII | Wurtemberg | Stuttgard .. | General von Schachtmeyer. |
| XIV | Baden | Carlsruhe .. | General von Obernitz. |
| XV | { Alsace and } Lorraine ... } | Strasburg .. | Lieut.-Gen. von Heuduck. |
| I Bav. | South Bavaria... | Munich ... | General Baron von Horn. |
| II Bav. | North Bavaria... | Wurzburg . | General von Orff. |
| Hessian Division | Hesse | Darmstadt . | Lieut.-General Prince Henry of Hesse. |

The composition of these various Army Corps is similar, though not absolutely identical. Each consists of two Infantry Divisions, and a Rifle Battalion, with force of Cavalry varying from twenty to forty squadrons, as a rule attached to the Infantry Divisions, nineteen batteries of Artillery, a force of Foot Artillery, a Pioneer Battalion, and a Train Battalion.

The following table shows the distribution of the troops in Army Corps in time of peace, but in some instances additional troops are attached, as in the case of the XVth Corps, which is strengthened by the addition of the Foot Artillery Regiment of the XIIth Corps, and a Battalion of the 2nd Bavarian Foot Artillery Regiment, as well as by a Brigade of Bavarian Infantry :—

¹ Cavalry Generals.

| Corps. | Divisional troops. | | | Corps artillery. | | | Cavalry divisions. | | Fortress artillery companies. | Pioneer battalions. | Train battalions. |
|----------------|--------------------|------------|------------------|----------------------------|------------------|----|--------------------|------------|-------------------------------|---------------------|-------------------|
| | Battalions. | Squadrons. | Field batteries. | Horse artillery batteries. | Field batteries. | | Regiments. | Squadrons. | | | |
| Guard | 27 | .. | 8 | 3 | 8 | 2 | 8 | 40 | 8 | 1 | 1 |
| I | 30 | .. | 8 | 3 | 8 | 1 | 5 | 25 | 8 | 1 | 1 |
| II | 27 | 30 | 8 | 3 | 8 | 1 | .. | .. | 16 | 1 | 1 |
| III | 24 | 30 | 8 | 3 | 8 | 1 | .. | .. | 8 | 1 | 1 |
| IV | 24 | 20 | 8 | 3 | 8 | 1 | .. | .. | 8 | 1 | 1 |
| V | 27 | 25 | 8 | 3 | 8 | 1 | .. | .. | 8 | 1 | 1 |
| VI | 27 | 25 | 8 | 3 | 8 | 1 | .. | .. | 8 | 1 | 1 |
| VII | 27 | 20 | 8 | 3 | 8 | 1 | .. | .. | 8 | 1 | 1 |
| VIII | 24 | 20 | 8 | 3 | 8 | 1 | .. | .. | 8 | 1 | 1 |
| IX | 24 | 20 | 8 | 3 | 8 | 1 | .. | .. | 4 | 1 | 1 |
| X | 24 | 25 | 8 | 3 | 8 | 1 | .. | .. | .. | 1 | 1 |
| XI | 27 | 20 | 8 | 3 | 8 | 1 | .. | .. | .. | 1 | 1 |
| XII | 30 | .. | 8 | 2 | 10 | 2 | 6 | 30 | 8 | 1 | 1 |
| XIII | 21 | 20 | 8 | .. | 8 | .. | .. | .. | 4 | 1 | 1 |
| XIV | 24 | 20 | 8 | 1 | 8 | .. | .. | .. | 4 | 1 | 1 |
| XV | 27 | .. | 8 | .. | 8 | 1 | 7 | 35 | 8 | 2 | 1 |
| I Bav. | 27 | 25 | 8 | 3 | 8 | 2 | .. | .. | 8 | 1 | 1 |
| II Bav. | 30 | 25 | 8 | 3 | 8 | 2 | .. | .. | 8 | 1 | 1 |
| Hessian Div. . | 12 | 10 | 4 | 1 | .. | .. | .. | .. | .. | .. | 0½ |
| | 483 | 335 | 148 | 46 | 146 | 20 | 26 | 130 | 124 | 19 | 18½ |

In the Army Corps, other than the Guard, the Infantry Divisions are numbered throughout consecutively. Thus the 1st Army Corps is composed of the 1st and 2nd Divisions, the IIInd Corps of the 3rd and 4th, and so on to the XIIth, which is composed of the 23rd and 24th Divisions. The independent Hessian Division, which is attached to the XIth Corps, is counted as the 25th, so that the XIIIth Corps consists of the 26th and 27th Divisions, the XIVth of the 28th and 29th, and the XVth of the 30th and 31st. The Infantry Brigades, of which there are two to each Division, are similarly numbered, the 1st Division consisting of the 1st and 2nd Brigades, the 2nd of the 3rd and 4th, and so throughout to the 31st Division, which consists of the 61st and 62nd Brigades.

The Bavarian Corps also consist of two Divisions each, but these as well as the brigades of which they are composed, have a separate enumeration, distinct from that of the Prussian Corps.

It will be seen from the table given above that in peace-time, except in the Guard, 1st, XIIth, and XVth Corps, the German Cavalry is not formed into independent Divisions, but is attached to the Infantry Divisions. This would not be the case in time of war, as the bulk of the cavalry would then be formed into Cavalry Divisions, and only one regiment of cavalry assigned to each Infantry Division, but with this exception the German Army Corps carries with it into the field the same organization that it has in time of peace.

Under no circumstances is one Army Corps made dependent on another, or on a central establishment outside its own province, for the supply of any stores or supplies necessary for it. Each corps is practically as independent and self-contained as if it were the army of some minor sovereign State, so that the preparations for taking the field can be carried on simultaneously in all, without any clashing of interests. This principle of decentralization has been so thoroughly carried out that as soon as the orders are issued to the Army Corps Commanders, each of these Generals can at once proceed to give effect to them, without further reference to the Imperial Headquarters in Berlin.

The same principle is also apparent in smaller units, the commanders of which are made as far as possible independent, and able to complete all preparations directly the mobilization orders reach them.¹

Landwehr.—In the table on p. 307, only the troops of the standing army have been referred to, but in addition to these the Army Corps Commander has under his orders the various units of the landwehr which belong to his district. The landwehr, as mentioned already, is a sort of militia in which men who have served for seven years in the standing army and reserve are enrolled, and in which they continue to serve for a period of five years; this period extending under ordinary circumstances from a man's 27th to his 32nd year. In time of peace the units, on the rolls of which these men's names are inscribed, have no existence as military bodies; only the cadres, or as we call them the "Permanent Staff," being kept up, in the case of the landwehr infantry battalions.² The landwehr, however, is not exclusively an infantry force, as it has an establishment of cavalry and artillery, but for these no cadres are maintained in time of peace, and they only commence to have an existence on the outbreak of war.

As a rule two landwehr battalions correspond to each infantry regiment, so that the number of landwehr battalions for whom cadres are maintained in time of peace is 300. If the rule were strictly followed the number would be 322, but in the case of the more recent additions to the German Army, the organization adopted in the older corps has not been closely adhered to. In consequence, however, of certain changes which were made in 1881, the number of landwehr battalions will increase progressively after 1888, and in 1893 will reach a total of 328. Landwehr infantry are formed into reserve regiments, brigades, and divisions, when required for active service.

The cavalry of the landwehr would in time of war consist of 24 reserve regiments, and 50 dismounted squadrons, and the artillery would be organized in 55 batteries; these troops being as a rule attached to the reserve divisions just mentioned, but also employed otherwise as they might be required.

Landsturm.—The landsturm has no military organization laid down either for peace or war. It is merely a list of those male inhabitants of the country who are of military age and fit to serve, whose names are not entered on the rolls of the standing army, the reserve, or the landwehr. A struggle which would necessitate the calling up of this force would be one in which the very existence of Germany as a Power would be at stake; for even in the War of 1870-71 it was never found necessary to have recourse to the landsturm, but if such an emergency should arise, the men belonging to this force would be drafted into the landwehr to fill vacancies in its ranks, and formed into newly raised landsturm regiments, to take a part in the defence of the country.

¹ It may be observed that there is telegraphic communication to every barrack throughout the Empire.

² These battalions may be called out for training, every man while in the Landwehr being liable to attend two trainings, each of 14 days.

II.—INFANTRY.

The German infantry of the standing army consists of 161 regiments of Guards, and Line, and 20 battalions of rifles. Regiments of Guards and line are further distinguished as Grenadiers, Infantry, or Fusilier Regiments, but these distinctions, like the corresponding titles in our own Service, have now ceased to have any military significance, and all these regiments are expected to perform similar duties.

The Infantry of the Guard consists of 9 regiments; viz.: 4 regiments of Foot Guards, 4 regiments of Grenadiers of the Guard, and 1 regiment of Fusiliers of the Guard.

There are 19 regiments of Grenadiers, of whom 12 are Prussian, 1 Mecklenburg, 2 Saxon, 2 Baden, and 2 Wurtemberg.

Of the 13 Fusilier regiments, 11 are Prussian, 1 Mecklenburg, and 1 Saxon.

Each regiment consists of three battalions, of which one is always styled a "Fusilier" battalion, the other two battalions in Guard regiments being called Grenadiers, and in the line Musketeers. These Fusilier battalions, unlike the Fusilier regiments, are intended for employment somewhat different from that of the other battalions, being used as light infantry, while the Grenadier or Musketeer battalions are for general service. All battalions, however, have a similar establishment, each consisting of four companies, which are not numbered independently for each battalion, but consecutively from 1 to 12 throughout the regiment.

Company.—The establishment of a company in peace and war is as follows:—

| | Peace. | War. |
|----------------------------------|-----------|-----------|
| Captain (Hauptmann) | 1 | 1 |
| 1st Lieutenant | 1 | 1 |
| 2nd Lieutenants | 2 | 3 |
| Sergeant Major-(Feldwebel) | 1 | 1 |
| Vice-Sergeant-Major | 1 | 1 |
| Portepée Fähnrich..... | 1 | 1 |
| Sergeants | 4 | 4 |
| Non-commissioned officers | 7 | 13 |
| Lance-corporals | 13 | 24 |
| Privates | 106 | 202 |
| Drummers | 2 | 2 |
| Buglers | 2 | 2 |
| Hospital Assistants | 1 | 1 |
| Train soldier | — | 1 |
| Tradesmen | 3 | — |
| | <hr/> 145 | <hr/> 257 |

The Captain of a German infantry company is a mounted Officer, being allowed forage for one horse in peace and two in war. The Portepée Fähnrich is a candidate for a commission, who takes rank after the sergeant-major and vice-sergeant-major, and is generally armed with a rifle.² Each of the four sergeants is in charge of a section of the company, and they, as well as the other non-commissioned officers, carry rifles, so that each com-

¹ The 89th Mecklenburg Grenadiers is an exception to this rule, as it consists of three grenadier battalions, and in Saxon and Bavarian regiments the rule is not observed.

² He carries a rifle until he has passed the examination for Officer's rank, when he is given a sword, and ranks above the sergeant-major.

pany on war strength has 243 or 244 rifles, according as the Fährnich is or is not armed in this way.

Of the 257 individuals forming a German company, all are combatants except the hospital assistant and the train soldier, but in the ranks there are four men trained as stretcher bearers, who though armed with rifles do not take their places in the ranks during an action, but are placed at the disposal of the medical Officer.

Battalion Staff.—An infantry battalion, which consists as already mentioned of four companies, has in addition the following staff :—

| | Peace. | War. |
|-----------------------------------|--------|------|
| Battalion Commander (Major) | 1 | 1 |
| Adjutant (Lieutenant) | 1 | 1 |
| Surgeons..... | 2 | 2 |
| Paymaster | 1 | 1 |
| Clerk | 1 | 1 |
| Drum-major | 1 | 1 |
| Armourer | 1 | 1 |
| Train soldiers..... | — | 16 |
| Sutlers and assistants | — | 4 |
| | 8 | 28 |

The battalion commander is allowed forage for 2 horses in peace and 3 in war, the Adjutant for 1 in peace and 2 in war, and the Surgeons and the Paymaster 1 each in war, so that the riding horses of the battalion staff are 3 in number in peace and 8 in war.

There are no wagons or draught horses with a battalion in peace, but in time of war each infantry battalion has 9 vehicles¹ and 24 draught horses. The complete peace establishment of a battalion thus amounts to 588 of all ranks, with 7 riding horses, and the war establishment to 1,056 of all ranks, with 16 riding horses, 24 draught horses, and 9 vehicles. Colours are carried by each infantry battalion, except in the 108th Saxon Regiment.

Regimental Staff.—An infantry regiment consists of three battalions of similar strength, the regimental staff being as follows :—

| | Peace. | War. |
|--|--------|------|
| Regimental Commander..... | 1 | 1 |
| Field Officer for interior economy | 1 | 1 |
| Supernumerary Captain..... | 1 | — |
| Adjutant | 1 | 1 |
| Staff Surgeon-major | 1 | 1 |
| Clerk | 1 | 1 |
| Musicians | 10 | 10 |
| Train soldiers | — | 7 |
| | 16 | 22 |

The regimental commander is allowed forage for 3 horses in peace and 5 in war; the Field Officer and Adjutant for 2 in peace and 3 in war; and the Staff Surgeon-major for 2 in war; the riding horses of the regimental staff thus numbering 8 in peace and 13 in war. There is only one vehicle belonging to the regimental staff, viz., a two-horse baggage wagon, so that the complete peace establishment of an infantry regiment amounts to 1,780

¹ 1 six-horse ammunition wagon, 1 four-horse battalion baggage wagon, 4 two-horse company baggage wagons, 1 two-horse pharmacy wagon, and 2 two-horse sutler's wagons. These are kept in peace-time at the headquarters of the regiment.

of all ranks, with 29 riding horses, and the war establishment to 3,190 of all ranks, with 61 riding horses, 74 draught horses, and 28 vehicles.

It will be noticed that on the staff of an infantry regiment there are only ten musicians, but the regimental bands are brought up to a strength of about forty-two performers by attaching two or three men from the ranks of each company. These men, however, being equipped and trained exactly like their fellows, have been included among the combatants.

The supply of ammunition and of food for a German soldier when on active service is provided for as follows:—As regards ammunition, each infantry man carries 80 rounds on his person, viz., 40 in two pouches on the waist-belt, and two packets of 20 each in a pocket at each side of the knapsack. Twelve rounds more per man are carried in the company wagon, and 20 in the battalion wagon, so that with the regiment there should be 112 rounds per man. The first reserve of ammunition is carried in the Army Corps ammunition columns, and provides for 60 rounds per man additional, so that 172 rounds per man are actually carried with a mobilized Army Corps.

On service, rations are issued in the usual way wherever this is possible, but to meet the case of an advancing force pushing far ahead of its trains, each infantry regiment has with it three days' provisions per man, which are called the "iron ration,"¹ and must not be touched except on the direct order of the General Commanding. These rations are partly carried by the men themselves and partly in the wagons, but they must always be with the troops, as well as three days' oats for each draught horse.

RIFLES.

Rifle battalions differ in no material respect from other infantry battalions, but being recruited exclusively from among the foresters they are specially valuable for service in a difficult country, on an advanced guard, or in any circumstances where a single battalion has to be employed. Of the 20 battalions of which the force consists, there is 1 of Rifles of the Guard and 1 of Sharpshooters of the Guard; 11 Prussian rifle battalions, 2 Saxon, 1 Mecklenburg, and 4 Bavarian.

There is no battalion ammunition wagon as in infantry regiments, but 40 rounds per rifle are carried in the company wagons, so that riflemen have close at hand a total of 140 rounds per rifle.

Training of Recruits.—We may now turn to the system which is adopted for the training of the infantry soldier. Each company receives in theory the same number of recruits annually,² but as the casualties in some companies are more than others, they are practically brought up each year to the regulated establishment. The number amounts to nearly one-third of the company establishment, or about forty-eight, and these men join generally at the beginning of November, about four weeks after the reservists whom they are to replace have proceeded to their homes.

During the interval which has elapsed since the departure of the reservists, everything necessary for the reception of the new comers has been prepared by the Captain of the company, and the recruits are at once told off to the rooms they are to occupy, each room having for its head a specially selected lance-corporal to maintain order and teach them their duties. These lance-corporals are 10 or 12 in number for each company, 3 or 4 being told off to each of the 3 squads into which the 48 recruits are usually divided. Each squad is under a non-commissioned officer, who with the aid of the lance-

¹ Consisting of biscuit, bacon, or preserved meat, rice, coffee, and salt.

² The number per battalion is fixed by Imperial Decree each year, and has stood at 190 for a considerable period.

corporals drills the recruits composing it, and lives as much as possible in their company. The supervision of the whole course of instruction of the recruits is entrusted to one of the Lieutenants of the company, who, like the non-commissioned officers, has been selected by the Captain on account of being specially suited for this work by reason of his attainments, good temper, and firmness. The course of instruction is accurately laid down by regulations which the instructors are obliged to follow, but beyond seeing that the rules are complied with, the Captain interferes little with the training of the recruits. Here, as in more important matters, the principle is that no duty is assigned to an Officer who is not considered to be capable of performing it satisfactorily, but that when the work has been begun, the responsible Officer is left to his own judgment as to the mode in which he will carry it out, knowing that he will be judged by the result.

On his first arrival the recruit is served out with his uniform, not by any means new, but still sufficiently clean and smart looking to induce him to take a pride in his cloth, and he is taught by the head of his room how to clean his accoutrements and how to put them on. Drill is at first made comparatively easy to the young recruit, who during his first week is only kept on parade for two hours in the morning and an hour and a half in the afternoon, but the next week half an hour is added to the length of both parades, and in the fourth week he is drilled for two hours and an half on each occasion. The arrangement of the recruits' course of instruction is left entirely to the discretion of the Captain of the company, who in his turn leaves great freedom of action as to details to the Lieutenant-Instructor. Thus the different companies of the same regiment may proceed in the training of their recruits on totally different lines, some Captains for instance commencing the manual exercise as early as the third day of a recruit's service, while others do not place arms in his hands till a considerably later date. With the different systems which may be adopted the Commanding Officer is careful not to interfere; all he concerns himself with is that when the inspection of the recruits takes place they shall come up to the prescribed standard.

The inspection is usually made about the 1st March, and the recruits have consequently had by this time some twelve or fourteen weeks' training, within which period it is expected that they will have thoroughly learnt all parade movements, and how to manœuvre in dispersed order. They must also be trained in gymnastics, in the use of their arms, aiming drill and bayonet exercise, as well as in the methods of keeping their arms, clothing, and accoutrements in serviceable condition. They must be familiar with all bugle calls, and have a general acquaintance with the articles of war and military regulations; information on the last-mentioned subjects being given in the winter evenings by the Lieutenant to whose care the recruits have been confided.

The inspecting Officer whose duty it is to see that the recruits have been properly trained is the Colonel of the regiment, and the very close examination which he makes of every individual recruit, obliges him to spend about two hours over the inspection of each company. So much importance is attached to this inspection that it is by no means unusual for the General Commanding the Army Corps to be present at it, and the keenest interest is taken by Officers of all ranks in the success or failure of the different systems adopted in the various companies.

On the day following the recruits' inspection they are passed into the ranks of the company, and thenceforward do duty in all respects as the old soldiers.

It is to be remarked that in thus transforming raw recruits into soldiers fit to take their place in the ranks in such a short space of time as three months, the process is materially assisted by the military training which all young

Germans receive while at school, as well as by the high standard of education diffused throughout the nation. The Lieutenant-Instructor of the company has not to waste his time on hopelessly ignorant dullards, but can count on every recruit with whom he has to deal having a good elementary education, and being thus able to benefit by the teaching which is to fit him for his duties as a soldier.

When the recruit drills are terminated and the company is brought up to its full peace establishment, the spring drills commence, and it may be remarked that in the prosecution of the extended series of exercises which are included under this head, the young soldier's instruction is comparatively little interrupted by guards and fatigues. On the average the German infantry soldier has about ten or eleven nights in bed, and every effort is made to reduce the number of men employed both on guard and on fatigue duties. Thus on any post where a sentry in the day time can be dispensed with, only a night sentry is employed, and the number of purely honorary sentries, at the gates of palaces, &c., is reduced to a minimum.

In the earlier part of the spring drills the men are exercised in route-marching by companies, and practised in constructing bivouacks and placing outposts. These marches are succeeded by company drill, in which the movements are simple, but where the men are taught to act with the utmost promptitude on their Captain's orders, whether those orders are in accordance with what is laid down in the regulations, or something totally different. By this system of making irregular and unexpected movements, the company becomes extraordinarily handy, and the men learn to obey a word or a sign from their Captain with mechanical accuracy.

The company drills last for about six weeks, and at their conclusion each company is inspected by the Colonel of the regiment, who, on finding the condition of all satisfactory, orders the commencement of battalion drill. This is now practised three days a week for about four weeks, the remaining days being devoted to company drill and rifle shooting. The battalion exercises are at first merely drill, carried out simply with the object of making the battalion easily handled and flexible, but afterwards every sort of field manœuvre which can occur in actual war is practised under the best conditions which can be obtained.

At the close of these drills each battalion is inspected by either the Brigade or Divisional Commander, these inspections usually taking place about the beginning of June.

In the course of the summer, whenever it is practicable, the three battalions of the regiment are manœuvred together, and at some stations brigade drill is practised, but very often when the battalion drills are completed, the troops are at once exercised in minor tactics. This work is done at first by companies, each Captain marching his men out into the country and teaching them in a practical way how to make themselves secure by outposts and patrols, while on the march out and homewards one half of the company is sometimes sent on, representing the rear guard of a retreating force, the other half representing the advanced guard of the pursuers, and endeavouring to keep the first in sight. The formation of bivouacks and the best ways of crossing hedges, ditches, and other obstacles are also practised, as well as the attack and defence of posts, and the construction of shelter trenches and simple field works. Swimming is taught universally, and concurrently with the above-mentioned exercises the troops of all ranks are constantly engaged in rifle practice.

Musketry.—The German military authorities act on the principle that the better the rifle with which the men are armed, the more important it is to teach them to use it properly; and hence the attention which is paid to musketry instruction is large and increasing in amount. Ball practice com-

mences in many instances before the recruit has finished his drill, the number of rounds fired on each occasion being as a rule limited to five, so that the men may not be tired or disgusted. For every infantry soldier, including Officers, an annual allowance of 130 rounds of ball cartridge is given, and some extra rounds beyond this number are assigned to those men who prove themselves to be bad shots. Practice in barracks with the miniature ammunition and the aiming tube is also encouraged, the only restriction on this being that a lance-corporal must always be present while it is being carried on.

The whole of the musketry instruction is carried out by the Officers and non-commissioned officers of the company, the men being united for instructional purposes in small squads of ten or twelve, so that every individual is brought directly under the eye of the Officer or non-commissioned officer who is responsible for his training.

The only time of the year when rifle practice is not going on is during the grand manœuvres, which take place every autumn. With these the military year may be said to terminate; for at their conclusion the reservists proceed to their homes, and preparations are made for the new batch of recruits who, as mentioned already, join each company in the month of November.

III.—CAVALRY.

There are 93 regiments of German cavalry, of which 10 are cuirassiers, 2 Saxon heavy cavalry, 2 Bavarian heavy cavalry, 28 dragoons, 20 hussars, 6 Bavarian light cavalry, and 25 uhlans or lancers.

The regiments are classed as guards and line, the guard cavalry being composed of 2 regiments of cuirassiers, 2 of dragoons, 1 of hussars, and 3 of uhlans. These are all Prussian regiments, but the cavalry of the line is made up of contingents from the various States. Thus Saxony furnishes 2 regiments of heavy cavalry, 2 of hussars, and 2 of uhlans. Bavaria has 2 heavy cavalry regiments, 6 regiments of light cavalry, and 2 of uhlans. Mecklenburg has 2 regiments of dragoons, Oldenburg 1, and Baden 3. Brunswick has 1 regiment of hussars, Hesse 2 of dragoons, Wurtemberg 2 of dragoons and 2 of uhlans. The remainder, viz., 8 regiments of cuirassiers, 16 regiments of dragoons, 16 of hussars, and 16 of uhlans, are Prussian.

All these regiments are identical in their organization and establishment, each consisting of five squadrons, the squadron being again divided into four sections.

When ordered on active service, however, a regiment only takes the field four squadrons strong, the remaining squadron being left behind as a *dépôt* squadron, and giving up to the service squadrons its trained men and horses in place of the recruits and inferior horses that may happen to be in the ranks when the orders arrive. The regiment can thus at the shortest notice take the field with four thoroughly efficient squadrons, while its requirements during the campaign are supplied by a system which requires the introduction of no fresh machinery. The squadron which thus acts as the regimental *dépôt* differs in no respect from the other squadrons, as the liability to be thus left behind, in case war should break out, is undertaken by a different squadron each year, according to a regular roster.

The peace and war strength of a squadron are as follows :—

| | Peace. | War. |
|-------------------------------------|---------------|-----------|
| Captain (Rittmeister) | 1 | 1 |
| 1st Lieutenant | 1 | 1 |
| 2nd Lieutenants..... | 2-3 | 3 |
| Sergeant-major (Wachtmeister) | 1 | 1 |
| Vice-Sergeant-major | 1 | 1 |
| Portepée Fähnrich | 1 | 1 |
| Sergeants | 4 | 4 |
| Non-commissioned officers | 8 | 8 |
| Lance-corporals | 20 | 20 |
| Trumpeters | 3 | 3 |
| Troopers | 96-97 | 112 |
| Farrier..... | — | 1 |
| Hospital assistant | 1 | 1 |
| Train soldiers..... | — | 6 |
| Tradesmen | 4 | — |
| | <hr/> 143-145 | <hr/> 163 |

The number of horses in peace is 140, and in war 174, including 2 draught horses for the squadron wagon. A squadron on war strength has 155 mounted combatants. A cavalry regiment, with 5 squadrons in time of peace and 4 in war, has the following staff:—

| | Peace. | War. |
|----------------------------------|----------|----------|
| Regimental Commander..... | 1 | 1 |
| Major for interior economy | 1 | 1 |
| Adjutant | 1 | 1 |
| Staff Surgeon-major | 1 | 1 |
| Assistant Surgeons | 2 | 2 |
| Staff Veterinary Surgeon | 1 | 1 |
| Veterinary Surgeons | 4 | 2 |
| Paymaster..... | 1 | 1 |
| Assistant Paymaster | 1 | — |
| Clerk | 1 | 1 |
| Trumpet-major | 1 | 1 |
| Armourer | 1 | 1 |
| Regimental saddler..... | 1 | 1 |
| Hospital assistants | 5 | — |
| Train soldiers | — | 14 |
| Sutlers and assistants | — | 4 |
| | <hr/> 22 | <hr/> 32 |

The Officer commanding a cavalry regiment is allowed forage for 3 horses in peace time and for 5 in war, the Major for 2 in peace and 4 in war, the Captains for 3 in peace or war, and the Lieutenants for 2 in peace and 3 in war.

Regimental Transport.—Each cavalry regiment has in time of war its own transport, consisting of 8 vehicles,¹ drawn by 18 horses, and attended to by 7 of the train soldiers, the remainder of these men being told off as Officers' grooms.

The total strength of a cavalry regiment on peace strength amounts to 737 of all ranks, and in time of war to 684, of whom 667 are mounted, the number of mounted combatants being 624.

¹ 1 four-horse headquarters' wagon; 4 two-horse squadron wagons, with portable forge; 1 two-horse pharmacy wagon, and 2 two-horse sutler's wagons.

Ammunition.—Each cavalry soldier who is armed with a carbine carries 50 rounds of ammunition, 20 being in his pouch and 30 in the wallets. Non-commissioned officers and others who have revolvers instead of carbines, carry 18 rounds each, or three complete charges for the six-chambered weapon with which they are armed. No ammunition is carried in the wagons of a German cavalry regiment, so that if a further supply is required, it must be obtained from the Army Corps ammunition columns, unless the regiment forms part of an independent Cavalry Division, in which case recourse might be had to the attached ammunition wagons, in which about 12 rounds per carbine are conveyed.

Iron Rations.—Iron rations for cavalry men are exactly the same as for infantry, and one day's iron ration of oats is carried for every troop horse.

Tradesmen Division.—Among the non-combatants attached to each cavalry regiment, and left behind when the regiment goes on active service, are 20 tradesmen, 4 for each squadron. These are attached to the dépôt squadron, and their numbers are increased to 60 of all ranks, thus forming a tradesmen division, whose duty it is to keep the regiment supplied with equipment of all sorts while in the field. They are under the superintendence of the Assistant Paymaster, who is detached from the regiment for this purpose.

The German cavalry are classed as heavy and light; cuirassiers and lancers being counted as the former, and dragoons and hussars the latter. Two to four regiments constitute a brigade, these brigades bearing the same numbers as the infantry Divisions to which they are attached. Where a cavalry brigade consists of an even number of regiments, they are usually half heavy and half light; but in the brigades which have three regiments, no fixed relation seems to be observed.

Horses.—Horses for the German cavalry are as a rule provided from the twenty remount dépôts, where they have been kept for a year or two, after having been purchased as three-year-olds, at an average price of about 34*l*. They are expected to last for eleven years, but a certain number of those which, at the end of this period are still fit for work, are only provisionally cast, and are retained for the instruction of one-year volunteers. Forage for these horses is supplied as well as for some supernumerary horses, which to the number of three or four may be kept by each squadron. In peace-time these supernumerary horses are used for drawing forage, and for the regimental transport during manœuvres, when, the regiment being still on the peace footing, no draught horses are provided, but on mobilization they are at once taken on the strength as effectives.

Subalterns' horses are supplied by the State, a few superior animals being sent from the remount dépôts for this purpose. Such horses, after having been five years in the Officer's possession, become absolutely his property; but an Officer who exchanges or leaves his regiment cannot take with him a horse which he has had for less than the full period. In such a case he would receive a sum of money representing his interest in the animal, proportionate to the length of time during which it has been in his care. If a charger is not supplied, a payment in money is issued, the amount allowed being about 25*l*. The number of remounts annually required in peace-time in the German Army for cavalry, artillery, and train amounts to about 6,000, and these are told off at the dépôts to the branch of the service for which they are best suited. Each cavalry regiment, battery, &c., sends a detachment to the dépôt from which it procures its remounts, and the men of this detachment take the horses back with them by railway, all the remounts thus reaching the corps at or about the same time, viz., in the month of July.

Each cavalry regiment receives sixty-three horses annually, giving twelve or thirteen to each squadron, exclusive of Officers' chargers, and this number

is never exceeded. If the squadron commander feels constrained to cast more than thirteen horses, or if in the course of the year some of the horses die, his squadron must remain below its establishment till the following year, when by casting less than thirteen, he can again bring his troop horses up to their proper number.

The number of rations of forage issued to each squadron is always for the full number of horses on the establishment, whatever the actual number of horses may be. It consequently happens, where from any cause this number is below the establishment, that a certain amount of surplus forage will be drawn, and this forage the commander of the squadron has the right to sell, and with the money thus obtained, purchase another horse or horses to remove the deficiency. By this arrangement squadrons are seldom left much below their proper establishment, and all intricacies of correspondence about forage returns are avoided.

Training of Recruits.—The instruction of cavalry recruits is carried on in a manner similar to that adopted in the infantry. The recruits join at about the same season, viz., in October; but as in the cavalry a very large proportion of the recruits are four-years volunteers, who join on the 1st October, while the ordinary recruits do not join till a fortnight later, it follows that the annual quota for a squadron forms two parties which cannot conveniently be instructed together.

Each squadron receives annually thirty-five to forty-five recruits, and these are usually formed into three or four squads to be trained, as in the infantry, by selected non-commissioned officers, acting under the superintendence of the Lieutenant-Instructor. Recruits must attend the riding school for six months, no matter how well they may be able to ride before joining, and as there is no riding-master, this course is entirely in the hands of the squadron instructors.

Before a recruit can be dismissed he must be able to manage his horse perfectly under all circumstances and at all paces, to cross all fences or other obstacles which he is likely to meet, and to understand thoroughly the use of his arms. As recruits if left to themselves might charge too wildly for their own safety or of that of their horses, this part of the training is always practised in company with an equal number of old soldiers, one of whom is told off to each recruit, who must regulate his pace by that of his more experienced comrade.

On the 1st May the recruits' course of drill is ended, and they take their places in the squadron, as do also the last batch but one of remounts, which in the twenty-one months that they have been with the regiment have been thoroughly broken in. The newest remounts are also used, but as they are not considered to be efficient troop horses, they are left in the hands of the men who act as rough riders.

Squadron drill lasts for about six weeks, during which time the squadron commander is constantly exercising his men in the field, his main object being to impress them with the idea that there is no formation from which the squadron cannot instantly charge the enemy, no matter on what side he may make his appearance.

When regimental drill begins in June, these squadron drills are not discontinued, but each Captain takes out his squadron on the days when there is no regimental drill, every horse being expected to do at least five days' hard work in each week. Any spare time which the men may have is employed in foot parades and rifle shooting, 40 rounds being allowed annually for each carbine and 15 for each revolver. The regulated allowance of ammunition is however supplemented by 15 additional rounds of carbine ammunition issued annually for each of the 120 best shots in the regiment, and besides this some extra rounds are obtained in lieu of lead recovered from the

butts, so that a German cavalry soldier has frequent opportunities of practising shooting.

Among other exercises which form part of the course of instruction the swimming of rivers by cavalry is important. This is practised once a week in summer at all stations where there is a river of sufficient size within reach, and with regiments which have had some experience the horses plunge in without hesitation, and carry their riders with their arms and accoutrements in safety to the opposite bank. Every sort of duty which can fall to the lot of the cavalry soldier is practised, but the art of making a rapid reconnaissance, and of briefly reporting the most important points, is cultivated with peculiar care. A non-commissioned officer, for instance, detached for such a purpose would have the exact circumstances under which he is acting carefully explained to him, and it is needless to say that the preparation of such problems entails a considerable amount of work on the regimental Officers by whom they are drawn up, and that before being capable of setting such tasks to their men, they must be possessed of an ample store of military knowledge.

Such a course of training renders the German cavalry soldier extremely self-reliant, and qualifies him for the duty which is peculiarly his own, that of being the eyes of the army.

IV.—ARTILLERY.

The German artillery is composed of two branches, viz., the field artillery and the foot or garrison artillery. The Officers and men of each of these branches belong to them permanently, and cannot be transferred from one to the other, this complete separation of the Officers having been carried out in 1872.

The field artillery is organized in regiments, two of which, with the ammunition columns, form a brigade, and one such brigade, with a regiment of foot artillery, is allotted to each Army Corps. One of the two regiments in a field artillery brigade is composed of two divisions, each of four field batteries, and this regiment furnishes the Divisional artillery, viz., four field batteries to each infantry Division. The other regiment of the field artillery brigade consists of three divisions, two of which are similar in composition to the divisions of the first regiment, while the third division is made up of three batteries of horse artillery; this regiment forms the corps artillery.

The field artillery with a German Army Corps amounts therefore to 19 batteries or 114 guns; of which 8 batteries or 48 guns are with the infantry Divisions, and 11 batteries or 66 guns are under the direct control of the corps commander, but of course when some of the horse artillery batteries are detached for duty with a cavalry Division, the corps artillery will be proportionally decreased.

As a rule, in time of peace only four guns of a German battery are horsed, the other two guns and the twelve carriages which are mentioned below being kept in store at the headquarters of the regiment.¹

The peace and war establishments of a German field battery are as follows :—

¹ Four field batteries of the Ist Corps, four of the IInd, and eight of the XVth Corps have 6 guns each in peace. These batteries have 9 men and 16 horses extra. Of the horse artillery batteries, three of the VIIIth, one of the XIth, one of the XIIth, and one of the XIVth Corps have 6 guns each. These batteries have 1 trumpeter and 10 gunners extra, with 30 additional horses.

| | Peace. | War. |
|--|-----------|-----------|
| Captain (Hauptmann)..... | 1 | 1 |
| 1st Lieutenant | 1 | 1 |
| 2nd Lieutenants | 2 | 3 |
| Sergeant-major (Feldwebel) | 1 | 1 |
| Vice-sergeant-major | 1 | 1 |
| Portepée Fähnrich | 1 | 1 |
| Sergeants | 4 | 4 |
| Non-commissioned officers | 10 | 8 |
| Corporals (Ober-gefreite) | 4 | 6 |
| Lance-corporals | 6 or 7 | 9 |
| Trumpeters | 2 | 3 |
| Gunners and drivers ¹ | 67 or 68 | 129 |
| Train soldiers | — | 5 |
| Farrier | — | 1 |
| Saddler | — | 1 |
| Hospital assistant | 1 | 1 |
| | <hr/> 102 | <hr/> 175 |

The establishment of a horse artillery battery is very similar as regards the men, the only difference being that both in peace and war there are 8 less non-commissioned officers and men, with 1 saddler extra in war.

The number of horses in a battery is as follows :—

| | Peace. | War. |
|---------------------------------|----------|-----------|
| Field battery ... { Riding..... | 16 | 32 |
| { Draught | 28 | 118 |
| | <hr/> 44 | <hr/> 150 |
| Horse artillery { Riding..... | 48 | 116 |
| battery { Draught | 28 | 114 |
| | <hr/> 76 | <hr/> 230 |

The twelve carriages which belong to a battery consist of eight ammunition wagons, three store wagons, and a forge wagon, all six-horsed.

Ammunition.—The number of rounds carried in time of war is as follows :—

| | Gun limbers. | Ammunition wagons. | Total. |
|--|-----------------|-----------------------|-----------|
| Field battery ... { Common shell | 120 | 440 | 560 |
| { Shrapnel | 60 | 160 | 220 |
| { Case | 18 | 16 | 34 |
| | | | <hr/> 814 |
| Horse artillery { Common shell (light) ... | 144 | 480 | 624 |
| battery { Shrapnel (light) | 72 | 192 | 264 |
| { Case (light) | 18 | 16 | 34 |
| | | | <hr/> 922 |

Particulars as to the two natures of guns with which the German artillery

¹ Of the 144 corporals, lance-corporals, and privates in a field battery on war strength, 48 are gun numbers, 68 are drivers, and 28 are in reserve.

is armed will be given later (page 358), and it is only necessary here to observe that the field artillery gun is known as the 9-cm. gun, and the horse artillery gun as the 8-cm. gun. The axletree boxes of the field battery gun are fitted with seats, so that with three gunners carried on the limber, a field battery can bring up on the guns themselves a sufficient number of men to work them.

Ammunition Columns.—The two ammunition columns which have been mentioned as being part of a brigade of field artillery are only formed on mobilization. Each of them consists of two infantry and three artillery sections, which carry respectively small-arm and gun ammunition.¹ These columns, though part of the Army Corps organization, are thus readily attached to the two infantry Divisions, if this should be desirable, and are capable of still further subdivision, by assigning one section to each infantry brigade, supposing a case to arise where a brigade has to be employed independently.

In the 10 sections of the Army Corps ammunition column 60 rounds are carried for each infantry rifle and cavalry carbine, 121 rounds for each field battery gun, and 135 for each horse artillery gun, so that with a German Army Corps there are in all 172 rounds for each infantry rifle, 110 rounds for each cavalry carbine, 256 rounds for each field battery gun, and 288 rounds for each horse artillery gun.²

Foot Artillery.—The foot artillery regiment belonging to each Army Corps consists of two battalions, each of four companies. The establishment of a company of foot artillery is as follows:—

| | Peace. | War. |
|--------------------------------------|-----------|-----------|
| Captain (Hauptmann) | 1 | 1 |
| 1st Lieutenant | 1 | 1 |
| 2nd Lieutenants | 2 | 2 |
| Laboratory sergeant (Feuerwerker)... | 1 | 1 |
| Non-commissioned officers..... | 19 | 19 |
| Corporals | 10 | 10 |
| Lance-corporals | 13 | 13 |
| Gunners | 74 | 160 |
| Hospital assistant | 1 | 1 |
| Trumpeters | 2 | 2 |
| | <hr/> 124 | <hr/> 210 |

The Captain of a company of foot artillery, like a Captain of infantry, is mounted, drawing forage for one horse in time of peace, and two in war.

The staff of a battalion of foot artillery is somewhat similar to the staff of an infantry battalion, but if employed independently it has an increased establishment, twenty-five laboratory sergeants-major and sergeants being then attached to it from the staff of the regiment.

The total number of battalions of foot artillery in the German Army is 31, of which 28 are formed into 14 regiments, and 3 are independent. Each Army Corps has one regiment, with the exception of the IXth, XIIIth, and XIVth

¹ An infantry section has 177 of all ranks, with 175 horses and 24 vehicles. An artillery section has 180 of all ranks, with 181 horses and 26 vehicles. Vehicles with small-arm ammunition are painted grey to distinguish them from those with artillery ammunition, which are blue.

² In a British Army Corps 162 rounds per infantry rifle would be carried, with 280 rounds for each 16-pr. gun, 298 rounds for each 13-pr. gun, and 300 for each 9-pr.

to which only a battalion is allotted, and the Xth and XIth, which are without this unit.¹

In time of peace the German foot artillery regiments do garrison duty in the various fortresses ; and in time of war are employed either in carrying out siege operations with the Army in the field, or are used to reinforce the garrisons of those fortresses at home which may be regarded as liable to attack.

In an Army Corps when mobilized the units under the command of the artillery commander would thus be 3 batteries of horse artillery, 16 batteries field artillery (114 field guns), 2 columns Divisions (*i.e.*, 10 ammunition columns), with 8 companies of foot artillery if required.

Training of Recruits.—The system of instruction for artillery recruits is similar to that adopted in the cavalry. Each battery of field artillery receives some thirty recruits in the month of November, the complement for a horse artillery battery being somewhat less ; and on the 1st April following these men take their places as gunners, and the battery is thoroughly drilled as a unit during the months of April, May, and June. July and the first half of August are devoted to shell practice, after which the battery takes part in the autumn manœuvres, with which the military year terminates.

Although the young men who join each year are classed as recruits until the 1st April, they are drilled along with the old soldiers of the battery for about three months before this date. It is only during the earliest portion of their military career that squads formed exclusively of recruits are to be seen, as it is considered that in order to learn the somewhat complicated duties of a gunner, association with those who have already been trained is of great value.

Recruits intended to act as drivers, though taught to ride, are not allowed to do duty with the battery during their first year's service, the drivers being in all cases furnished by men who are at least in their second year of service.

In order that no delay shall take place when a mobilization is ordered, it is the practice in the German artillery to carry out in every battery a complete mobilization of some indicated portion every year. All the batteries in the regiment then combine the portions they have mobilized, one furnishing a gun complete, one a wagon, one men, another horses, and so on, so that a fully mobilized battery is put together, which is thus annually available for all ranks to study. This battery, as it would stand on war strength, is then sent a short distance by railway for entraining and detraining practice, the whole of the operations being carried out in presence of the Officers, non-commissioned officers, and volunteers belonging to the regiment.

Gun Practice.—Practice with field guns is carried out, as has been mentioned already, in the months of July and August, the number of rounds allotted annually per battery being 244 common shell, 100 shrapnel, and 12 case, or 356 in all. As only 4 guns are available, it follows that each gun which is used fires 89 rounds annually.

The targets are of three sorts, representing skirmishers, formed infantry, and artillery respectively, and fire is opened at various ranges from 1,000 metres to 2,000 metres, or more if the ground allows ; but in every case the distance of the target must be estimated, being never known beforehand.

¹ The 2nd Foot Artillery Regiment and the 9th Foot Artillery Battalion as belonging to the Pomeranian and Sleswig-Holstein Corps respectively, are specially trained in coast defence. The 10th Foot Artillery Regiment belongs to the XVth Army Corps. It is formed of a battalion recruited from the territory of the Xth, and another from that of the XIth Army Corps. The 11th Foot Artillery Regiment, which belongs to the IIInd Army Corps, is employed in the fortress of Thorn.

V.—ENGINEERS AND RAILWAY TROOPS.¹

The German engineers are organized in peace time by battalions, styled "pioneer battalions," one of which is, as a rule, attached to each Army Corps. These pioneer battalions are similar in their composition to the battalions of foot artillery, each consisting of four companies,² which have the establishment given below:—

| | Peace. | War. |
|----------------------------------|-----------|-----------|
| Captain (Hauptmann)..... | 1 | 1 |
| 1st Lieutenant | 1 | 1 |
| 2nd Lieutenants | 2 | 3 |
| Sergeant-major (Feldwebel) | 1 | 1 |
| Vice-sergeant-major | 1 | 1 |
| Portepée Fähnrich | 1 | 1 |
| Sergeants | 4 | 4 |
| Non-commissioned officers..... | 10 | 13 |
| Lance-corporals | 9 | 22 |
| Privates..... | 90 | 155 |
| Buglers | 3 | 3 |
| Train soldiers | — | 11 |
| Assistant Surgeon | — | 1 |
| Hospital assistant | 1 | 1 |
| Sutler and assistant..... | — | 2 |
| | <hr/> 124 | <hr/> 220 |

The three first companies of a pioneer battalion are styled field companies, and are trained in pontooning and field work, while the fourth company, being a fortress company and not intended to accompany the field troops, is specially instructed in mining.

On mobilization, the battalion organization disappears, the battalion staff passing at once to the Army Corps staff, and the three field companies being allotted, one to each Division, and the third to the Army Corps.

Bridge Trains.—Three bridge trains are formed from the field companies who have charge of the *matériel* in peace-time, one of these trains being attached to the Army Corps and the others to each of the Divisions. A corps bridge train has the following establishment:—

| | |
|---------------------------------|-------|
| Captain | 1 |
| Lieutenants..... | 2 |
| Assistant Surgeon | 1 |
| Paymaster | 1 |
| Sergeants-major..... | 2 |
| Sergeants | 4 |
| Non-commissioned officers | 8 |
| Lance-corporals | 7 |
| Musicians | 3 |
| Train soldiers..... | 103 |
| Veterinary Surgeon | 1 |
| Shoeing smith..... | 1 |
| | <hr/> |
| Total | 134 |

¹ Additional particulars will be found in a paper by Capt. W. H. Hare, R.E., on "The Engineer Arm in Continental Armies," vol. xxix, p. 1159.

² The Bavarian companies have five companies each.

An Army Corps bridge train has, moreover, attached permanently from the corps pioneer company a force of 2 Officers and 62 non-commissioned officers and men, with 2 horses, so that the total strength of the bridge train amounts to 198 of all ranks.

Each Divisional bridge train has the following establishment:—

| | |
|--------------------------------|----|
| 1st Lieutenant | 1 |
| 2nd Lieutenant | 1 |
| Sergeant-major..... | 1 |
| Sergeant | 1 |
| Non-commissioned officers..... | 5 |
| Lance-corporals | 3 |
| Musicians | 2 |
| Train soldiers | 40 |
| | — |
| Total | 54 |

The bridging material, &c., accompanying each of these trains is conveyed as shown below:—

| Divisional. | Corps. |
|---------------|---|
| 1 | 1 2-horse baggage wagon. |
| 1 | 2 4-horse wagons with rack-sides. |
| 3 | — 4-horse tool wagons. |
| 2 | 2 6-horse wagons with trestles. |
| 6 | 26 6-horse wagons with pontoons and balks. |
| 1 | 2 6-horse wagons with tackle and pontoon appliances. |
| — | — |
| Total 14 | 33 vehicles. |

The number of horses for a Divisional bridge train is 88, and for a corps train 223, and the lengths of bridge which can be formed by these trains are 36·5 metres and 122 metres respectively. The total length of bridging material which accompanies a German Army Corps amounts, therefore, to 195 metres, or 215 yards.

The fourth or Miner Company in most Army Corps is expanded on mobilization into three fortress companies, *i.e.*, a second miner company and a reserve company, which remain in the Army Corps district unless required to take part in a siege, but in the Guard and in the IVth and VIth Corps it is the duty of this company to furnish the Field Telegraph Divisions, particulars as to which are given below.

The field pioneer companies, whose war strength has been already mentioned, are accompanied by four wagons, *viz.*, two four-horse wagons (one for tools and one for powder and guncotton), and two two-horse wagons (one baggage wagon and one sutler's wagon).

Field Telegraph Detachments.—Each field telegraph detachment which is formed consists of 4 Officers, 1 Surgeon, 11 employés, and 137¹ men, with 76 horses and 14² vehicles. The length of line which can be constructed by a telegraph detachment is 36 kilometres (22 miles), and the appliances for ten stations are also conveyed.

¹ 47 of these men, with 1 Officer, belong to the train.

² 6 six-horse telegraph equipment wagons; 2 two-horse office wagons; 3 two-horse officials' wagons; 2 four-horse wagons with rack-sides; 1 two-horse baggage wagon.

RAILWAY TROOPS.

Railway troops are not a branch of the pioneers in Germany, being under the railway section of the Great General Staff, but from the nature of their duties they are more closely allied to the pioneers than to any other branch of the Service, and it is from this source that most of the railway Officers are obtained.

The railway regiment which exists in time of peace¹ consists of two battalions, each of four companies, but on the outbreak of war this organization disappears, the largest unit then employed being the company. Companies of railway troops in peace-time are employed in various works of construction, and the repair of lines which have been destroyed, as well as in ordinary railway work, but the companies which are formed on mobilization have distinct functions to perform, being classed as construction companies, management companies, and works companies.

It is the duty of a construction company to repair as rapidly as possible the injuries which a retreating enemy may have caused to the railway lines, to lay fresh lines where required, and to render unserviceable any lines which it may be necessary to abandon to the enemy. Companies of this class therefore take the field with troops of the first line, and march among the leading troops. They are formed from the peace establishment of the regiment, and from the reservists and landwehr men who have been trained in its ranks.

Railway management companies are employed to take the place of the civilian officials on a captured line, and are also utilized for working the railway traffic immediately in rear of the field army. A company is considered to be sufficient for the management of a line of railway from 45 to 60 kilometres in length (28 to 37 miles), two or more companies being united under the same inspection. The *personnel* of the railway management companies is mainly obtained from the reserve men of the regiment, with the addition of some Officers, non-commissioned officers, and men from the peace establishment, but all railway employes in Germany who belong to the reserve or landwehr can also be ordered to serve in these companies, irrespective of the arm of the Service in which their colour service was passed, so that it has been calculated that the total number of men available is not less than 20,000.

Railway works companies furnish the *personnel* necessary for the loading and unloading of trains and the storing of goods in the railway depôts.

The establishments of these different companies are as follows:—

| | Construc- tion. | Manage- ment. | Works. |
|---------------------------------------|--------------------|------------------|-----------|
| Captain | 1 | 1 | — |
| 1st Lieutenants | 2 | 1 | 1 |
| 2nd Lieutenants | 6 | 4 | 1 |
| Assistant-Surgeon | 1 | — | — |
| Paymaster | 1 | — | — |
| Sergeants-major | 2 | 2 | 3 |
| Sergeants | 6 | 12 | 3 |
| Non-commissioned officers | 17 | 27 | 9 |
| Lance-corporals and privates | 175 | 159 | 186 |
| Train soldiers (Officers' grooms) ... | 11 | 6 | 2 |
| Hospital assistants | 1 | — | — |
| | <hr/> 223 | <hr/> 212 | <hr/> 205 |

¹ It is stated that it is the intention of the German Government to double the strength of the railway troops and form a brigade of 2 regiments.

A construction company has also, when advancing with the Army, a train column attached, consisting of 1 non-commissioned officer and 9 men, with 16 horses and 5 vehicles.¹ When the advance is on a line of railway, a special train for bringing up railway plant is attached to each company.

The four 2nd Lieutenants of a management company would be employed as station masters, while the sergeants and non-commissioned officers would supply the engine-drivers, guards, signalmen, &c., required for the working of the line, the privates acting as porters or cleaners of locomotives and carriages.

VI.—TRAIN AND DEPARTMENTS.

Each Army Corps in the German Service includes a train battalion which in time of peace consists of two companies, a *dépôt* and a section of workmen. A bakery section is also attached, and when mobilization is ordered these units are largely increased by the addition of reservists, and are given a very much wider development than might be expected from the peace establishment maintained. The train battalion in peace has only a strength of 12 Officers, 46 non-commissioned officers, 30 lance-corporals, 138 privates, 126 horses, and 24 vehicles, but in time of war it is expanded into the following units, viz., 5 commissariat columns, 5 wagon-park columns, 3 bearer companies, a field bakery train, and in some cases a reserve bakery train, with a *dépôt* of horses.

The establishments of the more important of these units are as follows :—

Commissariat Columns.—Establishment of a commissariat column (*Proviant-Colonne*):—

| | |
|---------------------------------|----|
| Captain | 1 |
| Second Lieutenant..... | 1 |
| Paymaster | 1 |
| Veterinary Surgeon | 1 |
| Farrier | 1 |
| Sergeants-major..... | 2 |
| Sergeants | 2 |
| Non-commissioned officers | 7 |
| Lance-corporals | 16 |
| Musicians | 2 |
| Privates (tradesmen)..... | 8 |
| Train soldiers..... | 76 |

118

The vehicles in which the commissariat stores are transported are 30 four-horse provision wagons, with 1 four-horse reserve wagon and a six-horse field forge, the total number of horses allotted to a column being 167.

The whole of the wagons for the commissariat columns of the Army Corps, as well as for most of the other formations into which the train battalion is expanded on mobilization, are kept at the train *dépôt*;² and in order that these vehicles may be in thoroughly serviceable condition at any given moment, it is the practice to “mobilize” certain of the wagons every year, in the same

¹ 2 four-horse tool wagons; 1 four-horse wagon with rack-sides; 1 two-horse baggage wagon; 1 two-horse cabriolet.

² These *dépôts* are established at the following places: Guard Corps, 1st *dépôt*, Berlin, 2nd, Liebenwalde; I Corps, Königsberg; II, Alt Damm, near Stettin; III, Berlin; IV, Neustadt, a suburb of Magdeburg; V, Posen; VI, Breslau; VII, Münster; VIII, Coblenz; IX, Rendsburg; X, Hanover; XI, Cassel; XII, Dresden; XIII, Ludwigsburg; XIV, Carlsruhe; XV, Strasburg; ditto, supplementary, Metz; I Bav., Munich, ditto, supplementary, Ingolstadt; II Bav., Würzburg; 25th Division, Bessungen.

way as portions of each battery of artillery are annually mobilized. These wagons are fully loaded with the stores which they would have to carry on service, and in order that no time may be lost in this work, not only is there on every package which is to be conveyed a label showing the wagon and the part of the wagon where it is to be placed, but in every wagon the list of contents shows also in what storehouse and press the articles are to be found.

Two commissariat columns are attached in time of war to each infantry Division, the fifth column being for the corps artillery and other corps troops, and it is calculated that four days' supplies for the Army Corps can be thus conveyed. During an advance these columns follow the troops to which they are attached, and furnish them with supplies when closely concentrated for action, being also employed for the removal of the sick and wounded. When the Army is stationary the transport of these columns is utilized for bringing up supplies from the nearest railway station or advanced depôt, but it cannot be taken for any other purpose except on the order of the General Commanding the Army Corps.

Wagon-Park Columns.—Besides the commissariat columns there are for each Army Corps the same number of wagon-park columns (Fuhr-Park-Colonnen) and also a sixth column which is for service on the line of communications. The establishment of one of these columns is similar to that of a commissariat column, but there are 105 train soldiers, and the total of all ranks is 142. Each of these columns has 82¹ vehicles and 205 horses, and is intended to convey a six days' supply of forage and flour for the Army Corps, so that counting the 3 days' iron ration which each soldier carries and one day's ration carried in the company wagons, provision is thus made for the conveyance of 8 days' supply for each man, besides flour for 6 days more, and forage for each horse for either 7 or 9 days, according as supplies for 1 or 3 days are carried with the troops. If the wagon-park columns were loaded exclusively with provisions, supplies for 9 days might be sent forward by this means, and if these columns were employed only in conveying forage, the number of days' supply thus carried for the horses of the Army Corps would be 7.

It is to be observed that the wagons required for these columns are not kept in store, but large contractors bind themselves annually to place at the disposal of the Government the required number of covered wagons the instant hostilities may break out. No such arrangements are necessary for the supply of horses, as these are obtained by requisition.

Bearer Companies.—The establishment of a bearer company (Sanitäts Detachment) is as follows :—

| | |
|-----------------------------------|-----|
| Captain | 1 |
| First Lieutenant | 1 |
| Second Lieutenant | 1 |
| Staff Surgeons | 2 |
| Assistant Surgeons | 5 |
| Field apothecary | 1 |
| Paymaster | 1 |
| Hospital assistants | 8 |
| Sergeants-major..... | 2 |
| Sergeants | 5 |
| Non-commissioned officers | 12 |
| Lance-corporals | 19 |
| Musicians | 2 |
| Privates (stretcher bearers)..... | 165 |
| Train soldiers | 25 |

¹ 80 two-horse wagons, and 2 two-horse squadron baggage wagons.

There are in all 45 horses with a bearer company, and 12 wagons,¹ exclusive of a two-horse sutler's wagon which accompanies each of these units.

One of these bearer companies is attached to each infantry Division, the third being at the disposal of the Army Corps Commander, but under ordinary circumstances attached to the corps artillery.

The men who are employed in the bearer companies are specially selected for this duty, a certain number of privates in their second year of service being permitted each year to pass from the line into this branch of the service. The men so selected must be of superior attainments in order that they may profit by the special instruction which is given to them, and none but men of the best character are taken for this employment. Their training includes instruction in finding wounded men, with which object they are practised in discovering some of their comrades who are sent out previously to hide themselves in holes and bushes such as wounded men might crawl into, and they are moreover taught how they can recognize whether an apparently dead man is or is not actually a corpse. The modes of resuscitating those who are thus to all appearance dead are explained, as well as the proper ways to stop bleeding, while carrying the wounded so as to cause them the least amount of pain is practised by making the stretcher bearers march out of step.

Ambulances.—There are several patterns of ambulances used in the German service, the older description carrying 2 men badly wounded, lying down, or 3 men sitting up, with 7 stretchers, and the new pattern, 4 men lying down, 2 men sitting up, and 8 stretchers. With each bearer company there are, therefore, either 56 or 64 stretchers according as the equipment is of the old or new pattern.

Field Bakery Train.—The field bakery train, formed on mobilization in each Army Corps, has a strength of 115 of all ranks, with 15 horses and 2 vehicles.² This train is composed of two sections, the men in one section being exclusively bakers, while those in the other are butchers, cattle-drivers, masons for the construction of ovens, &c. Travelling ovens are not supplied to Army Corps bakery trains, but two such vehicles form part of the equipment of a reserve bakery train, of which units there is one for each separate Army. The Army Corps bakery trains do not follow the corps closely; being generally left at some convenient spot, and moved as seldom as possible.

Horse Dépôts.—Horse dépôts are maintained to make good casualties without delay, and consist of 115 of all ranks, with 201 horses and 2 baggage wagons.

ARMY DEPARTMENTS.

In the German Army the branches of the Service which we know by the name of the Departments of the Army are the Commissariat, the Medical Department, the Veterinary Department, the Legal Department, the Postal Department, and the Chaplain's Department.

Commissariat.—The commissariat (Intendantur) consists of two classes of Officers, viz., the administrative Officers who are attached to the Staff of Divisions or Army Corps, and the executive Officers who belong to the commissariat and wagon-park columns.

The duties of this Department are divided into four branches, viz., accounts; subsistence; clothing; garrison and hospital administration. Under the first of these branches are included the paymasters who are doing duty with the various corps, and who relieve the company commanders and others in analogous positions of all trouble with regard to the men's accounts.

¹ 8 two-horse ambulances, 2 two-horse pharmacy wagons, and 2 two-horse baggage wagons.

² A four-horse bakery equipment wagon and a four-horse reserve wagon.

The subsistence branch attends to the contracts for provisions and forage, and the proper maintenance of the stock of rations required for the Army on mobilization, while the clothing branch controls the action of the regimental clothing committees,¹ and the remaining branch concerns itself with hospitals and barracks.

The Corps Intendant is in some respects directly responsible to the War Minister, and is thus partially independent of the General Commanding the Army Corps; but this independence has much less practical effect under the purely military administration of the German War Office than in countries where the War Minister and his subordinates are civil functionaries.

Medical Department.—The Medical Department has also a certain number of administrative Officers who serve on the Staff of Army Corps and Divisions, while the great bulk of the *personnel* of this branch of the service is employed directly with the troops. The numbers of those thus employed have been given with the staffs of the various regiments, &c., but in addition to these a very large proportion of the medical profession in Germany is in time of war required for service in the field hospitals.

Field Hospitals.—These hospitals are each calculated for the reception of 200 patients, and have the following establishment :—

| | |
|---------------------------------|----------------|
| Surgeons | 5 ² |
| Field apothecary | 1 |
| Hospital inspector | 1 |
| Accountant | 1 |
| Hospital assistants | 9 |
| Non-commissioned officers | 5 ³ |
| Hospital orderlies | 12 |
| Cook | 1 |
| Trumpeter..... | 1 |
| Train soldiers | 19 |
| | — |
| | 55 |

With a field hospital there are 32 horses and 6 vehicles,⁴ the Surgeons being all mounted.

For each Army Corps there are 12 such field hospitals, and these draw their equipment on mobilization from the train battalion of the corps. In addition to these, however, there is established in time of war a hospital reserve dépôt for each army in the field, and from this dépôt the field hospitals draw supplies of hospital stores as may be required, and replace casualties which may occur in the *personnel*.

The line of communications (Etappen) hospitals have an establishment of about three times the strength of a field hospital,⁵ but have no horses or vehicles. The Surgeons, however, are allowed train soldiers to act as grooms for their private horses.

The German Medical Department is supplied with Officers partly from those who have been trained at the military medical institutions with the object of joining the Department, and partly from those young men who intend to practise afterwards as civil physicians or surgeons, and who fulfil their military obligations in this capacity.

Veterinary Department.—The Veterinary Department is represented by the

¹ See page 352.

² 1 Surgeon-major, 1 Surgeon, and 3 Assistant Surgeons.

³ 2 of these belong to the train.

⁴ 3 four-horse utensil wagons; 2 two-horse ambulances, and 1 two-horse baggage wagon.

⁵ Each of these hospitals has 19 Surgeons.

Veterinary Surgeons who are attached either to the Staff of the Army Corps, or to the various regimental units. Candidates for this branch of the Service have usually been educated at the Army Veterinary School in Berlin.

Legal Department.—The Legal Department consists entirely of the auditors attached to the Staff, two of these officials being allotted to each infantry Division, and one of superior grade to each Army Corps. They have duties to perform which are somewhat analogous to those of a Judge Advocate in our Service, but these duties include taking part in the preliminary investigation, by which a decision is arrived at, whether the case should or should not be sent for trial.

Postal Department.—The Postal Department is a small one, but it has been organized with quite as much care as those branches which are of more direct importance to the well-being of the troops. To each Division and to the corps artillery is attached in time of war a section consisting of 5 postal officials, 13 men, 12 horses, and 2 two-horse wagons, and to each Army Corps a somewhat larger section, viz., 4 officials, 17 men, 19 horses, and 4 two-horse wagons. These postal sections do not exist in peace-time as part of the normal organization of the German Army, but in each large garrison there is a military post office for the transmission of official correspondence which would otherwise be sent by orderlies. To this little post office, which is established in a central position, each corps sends an orderly once a day with the outgoing letters, and the same orderly brings back any letters which are addressed to his corps, this military post office thus resembling a bank clearing house. The business of the office is managed by two lance-corporals who are relieved every three months, so that without drawing on the resources of the Imperial Post Office, the Army has always available a number of soldiers who are trained in the work of sorting and dispatching correspondence. When on service the field post office forwards both official and private correspondence as well as post-cards, newspapers, and money orders.

Chaplain's Department.—Chaplains are attached to infantry Divisions in the proportion of two to each, and one of the corps artillery, making a total of five for each Army Corps. They belong to the Lutheran Church, but in the case of twelve Divisions which are territorially associated with districts where the prevailing religion is the Roman Catholic, an additional chaplain of this denomination is appointed.

VII.—RECRUITING.

In Germany every man is liable to military or naval service, and cannot free himself from this liability either by purchasing exemption or by providing a substitute. To this rule exceptions are made only in the case of members of reigning houses, and in time of peace in favour of the sole supporters of families, or of parents who are incapable of work. As has been mentioned in an earlier part of this paper, the liability to military service commences at 17 years of age, but as a rule men are not required to join the Army till they are in their 21st year. As the number of young men in the German Empire who annually attain the age of 20 years is calculated to be over 400,000, while the contingent fixed for the Army is only 151,000 exclusive of volunteers, it is plain that this rule of furnishing personal military service to the State affects considerably less than half of the community in time of peace. Those, however, who are thus exempted are not the most desirable recruits, as the men who are to serve in the ranks are not selected till all those who are physically unfit, or undersized, have been eliminated. The number of men who are absolutely unfit to be made use of in any military capacity is comparatively small, and of those who appear unfit or undersized in their 20th year, many are found suitable a year or two later.

One per cent. of the population is taken as the basis of calculation for the strength of the Army in peace-time, and this is maintained very accurately, as the population of the German Empire in 1884 was ascertained to be 45,234,000, while the establishment of the Army for 1885-86 amounts to 457,705 of all ranks.

The number of recruits who are to join each unit is annually fixed by an Imperial Decree, the numbers at present standing as follows :—

| | | |
|---|-----|----------------|
| For the Guards and 7 specified infantry regiments of the line | 225 | per battalion. |
| For all other infantry and rifles | 190 | „ |
| For each cavalry regiment at least | 150 | per regiment. |
| For each horse artillery battery at least | 25 | per battery. |
| For each field battery at least..... | 30 | „ |
| For the foot artillery regiments Nos. 8 and 10.... | 200 | per battalion. |
| For all other foot artillery regiments | 160 | „ |
| For the railway troops at least | 135 | „ |
| For each train company { for three years' active service..... | 15 | per company. |
| { for half year's service | 44 | „ |

The following table, the figures of which relate to the year 1883, will explain the manner in which the recruiting operations are carried on :—

| Age. | Morally unfit. | Physically unfit. | Passed to Ersatz Reserve. | Taken for service in the ranks. | Total. | Volunteers.] |
|-----------------|----------------|-------------------|---------------------------|---------------------------------|---------|--------------|
| 20 years | 307 | 35,666 | 14,036 | 66,102 | 116,111 | 13,955 |
| 21 „ | 298 | 11,772 | 9,503 | 37,114 | 58,687 | 2,336 |
| 22 „ | 289 | 17,613 | 124,402 | 36,888 | 179,192 | 1,535 |
| Above 22 years. | 458 | 3,424 | 4,118 | 1,713 | 9,713 | 2,479 |
| Total | 1,352 | 68,475 | 152,059 | 141,817 | 363,703 | 20,305 |
| Percentage | 0·4 | 18·8 | 41·8 | 39·0 | 90·9 | 5·1 |

In addition to those who are included in this table, there were in the year 1883, 15,877 young men who had emigrated without permission and thus escaped being drawn for military service.

Those who are held to be morally unfit to serve their country are men who have been sentenced to confinement in a house of correction, and whose offences are of such a nature that it is hopeless to expect that they will turn out reformed characters. Those, however, who at the time when they should be brought forward to take part in the drawing, are undergoing imprisonment of more than forty-two days, or who have been deprived of their civil rights, are not thereby exempted, but are classed among those who are temporarily unfit, and are brought up again a year later with those whose defect was physical rather than moral.

A man is not considered to be physically unfit unless he is maimed or so deformed as to be evidently incapable of employment in any military capacity as long as he lives. The subsidiary services of the Army are so varied that the number of men who are thus judged incapable of serving is not very large, as in such capacities men may be usefully employed who could not be allowed to take their places in the ranks.

In deciding on the fitness of a man to serve in the ranks the conditions first

looked to are chest measurement and height. No one is accepted whose chest measurement is below 80 cm. (32 in.) while the minimum heights of recruits for the different branches of the service are as follows :—

Guards : 170 cm. (5 ft. 7 in.) one half to be 175 cm. (5 ft. 9 in.) and in exceptional cases men of 167 cm. (5 ft. $6\frac{3}{4}$ in.) are taken.

Infantry, rifles, and train 157 cm. (5 ft. 2 in.).

Cuirassiers, lancers, and foot artillery, 167 cm. (5 ft. $6\frac{3}{4}$ in.).

Dragoons, hussars, field artillery, pioneers, and railway troops, 162 cm. (5 ft. 4 in.). In exceptional cases men of 157 cm. (5 ft. 2 in.) may be taken for dragoons and hussars.

In certain branches of the Service there is also a maximum standard of height. Thus recruits for the rifles, cuirassiers, lancers, train, and horse artillery must not exceed 175 cm. (5 ft. 9 in.) while the limit for dragoons and hussars is 172 cm. (5 ft. $7\frac{3}{4}$ in.).

The minimum limit of 157 cm. (5 ft. 2 in.) for infantry may appear low to us, considering that the minimum limit for our infantry is 5 ft. 4 in., and we are disposed to regard one of our line regiments as decidedly undersized if it has in its ranks many men under 5 ft. 6 in., but it is to be noted that the minimum height for recruits is higher in Germany than in any other Continental army.¹

Men in Germany who are below the prescribed standard of height, but who do not appear to have yet reached their full stature, are put back as being temporarily unfit, and have to present themselves again when they are a year older. If by that time they have grown sufficiently, they are admitted to the lot drawing, but if still undersized they are put back for another year, when if suitable they are accepted, but if unsuitable they are passed into the Ersatz Reserve, and are not called on to join the standing army.

Men may be passed into the Ersatz Reserve the first, second, or third time that they present themselves, but as may be seen by the table on page 305, the great majority are retained as temporarily unfit until they are 22 years of age, not being sent to the Ersatz Reserve till it is absolutely certain that they cannot be made available for the active army.

In the same way men who at 20 years of age claim exemption by reason of being the sole supporters of their family, &c., are not permanently excused on proving this to be the case, but must present themselves each year till they are 22 and show to the satisfaction of the Recruiting Commission that their circumstances have not altered in the meanwhile.

The Ersatz Reserve, which receives all the young men who from any of these causes are not taken into the active army, keeps their names on its lists till they have completed their 31st year, and during this time they are liable in case of war to be called on to fill vacancies in the ranks of the active army, thus taking the places of men of their own age. This Ersatz Reserve is, however, divided into two classes, into either of which a man may be passed according to his physical fitness for military service. Those who are best suited for taking their place in the ranks, but who have not been drawn for the active army, either by reason of being below the minimum height, or because they obtained a high number in the lot drawing, are placed in the first class, while those who are less eligible form the second class. Neither of these classes received any military training whatever in former years, but in 1880 authority was obtained from Parliament for the calling out of a portion of the first class, so that in the event of war, when these men would be required for service, they might not be absolutely ignorant of military duties. The number of the first class to be thus trained was calculated on

¹ Austria, 5 ft. $1\frac{1}{2}$ in. ; France, 5 ft. $0\frac{1}{2}$ in. ; Italy, 5 ft. $1\frac{1}{2}$ in. ; Russia, 5 ft. $0\frac{1}{4}$ in.

the basis of the requirements of the army on mobilization being supplied by five annual contingents, and as this is taken at about 100,000 the number annually called up for training since 1881, when this system was commenced, has been about 20,000.¹ The total number of men who join the first class annually is, however, about 60,000, so that two-thirds of this class remain without any military instruction. Those who are called up have to attend for a period not exceeding ten weeks for their first training, four weeks in their second year, and a fortnight in each of the two succeeding years.

Under ordinary circumstances a man who has been passed into the first class of the Ersatz Reserve remains in it for five years and then joins the second class till he completes his 31st year, but in the case of those who have been trained as mentioned above, there is no transfer to the second class, these men remaining in the first class, and consequently liable to immediate military service, up to the date when they cease to belong to the Ersatz Reserve. The number of partially trained men therefore which may eventually be obtained from this reserve will amount to considerably over 150,000. Men of the first class of the Ersatz Reserve are called up for training in the following order: those are first taken who have drawn high numbers, and then the remainder in proportion to their fitness for military service. On completing his 31st year a man passes into the landsturm till he is 42 years of age, when his military liability finally ceases.

Ersatz Commissions.—In Germany the recruiting business is managed by what are called Ersatz Commissions. For each regiment of infantry (other than the Guards, who are recruited throughout the Empire) there is a recruiting district, and this district is divided into two landwehr battalion districts, which are in their turn divided into four company districts.² An Ersatz Commission to deal with the recruiting business is assembled every year in each of the 275 landwehr battalion districts, and is composed of the commander of the landwehr battalion, an administrative official, some civilian members, and an infantry Officer.

This Commission meets in the early part of each year, and all the young men in the district who become liable to military service during the current year have to appear before it. They are examined medically, and any men who claim exemption, or who are desirous of postponing their service, lay before the Commission the grounds on which their application is based. All simple cases are there and then decided, but any points which the Commission considers to be beyond its powers are referred to the Ober-Ersatz Commission, of which there is one for each infantry brigade district.

The Ersatz Commission having heard the various petitions, and having decided what men shall be put back for a year on account of want of height, &c., and what men shall be drafted at once into the Ersatz Reserve, proceeds to assign to each of the remaining young men his place on the district recruiting list. This is done by lot drawing, the requisite number of recruits being eventually taken from those who draw the lowest numbers.

In order that no young man shall escape coming before the Ersatz Commission, this body is supplied each year with an extract from the register of births, showing the names of those within the district who have become liable to military service since the last return; and all who have become domiciled within the district, or who may be living in it without being domiciled, are bound to report themselves to the Commission on attaining the military age. Any young man who neglects to report himself, or who fails to present himself before the Commission when required, forfeits his right to draw lots,

¹ In 1881 nearly 40,000 were called up, but in 1882 and 1883 the number was 21,000, and in 1884, 18,000.

² Particulars as to the landwehr battalion districts will be found in No. 457, "Revue Militaire de l'Étranger," May 1879.

and is in the end, unless he quits the country, drawn for service before all other conscripts.

Ober-Ersatz Commission.—The Ober-Ersatz Commission, which, as has been stated, decides matters which are beyond the competence of the ordinary Ersatz Commissions, has for its president the infantry brigade commander, the members of this Commission being an administrative official and a civilian, with a Field Officer of the Guard who is attached with the special object of looking after the recruiting for the Guard Corps.

The number of these Ober-Ersatz Commissions corresponds to the number of infantry brigades, exclusive of the Guard, and is consequently seventy-one, while the number of ordinary Ersatz Commissions is about four times as many.¹

The Ober-Ersatz Commissions assemble every year in the summer, and visit each of the districts in which the ordinary Ersatz Commissions have held their sittings in the earlier part of the year. All young men who have not been put back by the ordinary Commission must then appear again, and after a further medical examination, and a consideration of the cases left to their decision, the Ober-Ersatz Commission proceeds to levy recruits according to the requirements of the service, taking care to select a certain number of supernumeraries in order to be prepared for casualties.

In levying recruits for the Army the young men are selected in the following order :—Those who have neglected to enrol their names, or failed to appear on a former occasion, are first taken ; then those who in the previous year drew low numbers but from any cause were not taken ; then those who draw lots in the current year, in the order of their drawing. If the numbers thus available are insufficient, the Ersatz authorities can draw on some young men whom they have retained at disposal from previous years, and if these should still leave the number below the contingent required from the district, recourse is had to the supplementary district, of which there is one for each Army Corps, to make up the deficiency.

Any appeal from the ruling of the Ober-Ersatz Commission is decided by the Army Corps Court, which is composed of the General Commanding the Army Corps, and a civil functionary, and the final appeal rests with the Minister of War of the State in which the recruiting district is situated.

The men who are thus selected for service by the Ober-Ersatz Commissions are sent to their homes, on furlough, and handed over to the landwehr authorities until they are required to join in the autumn. Before they are sent to join their corps the commander of the landwehr battalion district satisfies himself that each recruit is supplied with a good and sufficient stock of wearing apparel ; and where the man is not so supplied, and is too poor to obtain the necessary clothing for himself, it is furnished by the civil authorities, and the cost paid by the parish or district to which the man belongs, if his relations are unable to meet the expense.

VOLUNTEERS.

In the German Army there are two classes of volunteers, viz., three-years and one-year, and any young man who has reached the age of 17 years may, with the consent of his parents or guardians, apply to enter the Army as a volunteer of one or other of these classes.

Three-Years Volunteers.—Those who volunteer for three years apply to the civil president of the Ersatz Commission of their district, and on proving that they are of blameless character and free from all civil ties they may be accepted as candidates. The advantages which a young man gains by

¹ As special arrangements are adopted for recruiting in Alsace and Lorraine, the numbers do not correspond exactly.

volunteering for three years are that he can begin his service if it suits him two or three years before the normal age, and that he can select the particular arm and regiment in which he wishes to serve. For the cavalry the period of service for volunteers is four years instead of three, but in consideration of the extra year so passed in the ranks, their time of service in the landwehr is reduced by two years.

In the infantry of the line the number of three-years volunteers annually received must not exceed ten per company or forty per battalion, and if there is no vacancy in the corps for which a young man volunteers, his name is put down for it, and he is sent on furlough until a vacancy occurs. In the cavalry and rifles, however, there is no restriction to the number of this class of volunteers, and the Commanding Officer may take as many volunteers as he chooses, provided he does not go beyond the peace establishment laid down. As the three-years volunteer while in the ranks differs in no respect from any other soldier who is fulfilling his obligation to serve the State for a like period, this class of volunteers is really only a class of soldiers who have entered the service by voluntary enlistment instead of by conscription.

One-Year Volunteers.—The one-year volunteer on the other hand stands in a totally different position. He is essentially a supernumerary, and in consideration of having only one year's service in the ranks, he has to pay the whole of his own expenses, and costs nothing to the State. For a young man to enter the Army as a one-year volunteer he must apply when he is between the ages of 17 and 20, and in addition to the consent of his parents or guardians, and a certificate of irreproachable conduct, he must produce a certificate of intellectual attainments from certain specified schools or colleges, or failing this must pass an examination which will prove him to be possessed of a corresponding amount of knowledge.

The number of one-year volunteers who can be received is limited to four per company of infantry, and three per battery of artillery, but the number admissible into a squadron of cavalry is not fixed. Commanders of squadrons, however, are not as a rule desirous of having many one-year volunteers under their orders, as they have already a large proportion of the four-years volunteers, and it is not always certain that a young man can be turned into a creditable trooper in a year.

While a three-years volunteer can enter on his service before the normal age of 20 years, if it suits his convenience, the one-year volunteer has the additional privilege of postponing the date of his entry into the Service till his 23rd year, if he wishes from any reason to delay the commencement of his military service. Of course a young man cannot thus postpone his entry unless when he is 20 years of age he has satisfied the Ersatz Commission as to his fitness to be received as a one-year volunteer, and he must at the same time have selected the capacity in which he proposes to serve. It is by no means obligatory on a one-year volunteer to serve exclusively as a combatant, as in the event of his being a medical or veterinary student he may be employed while in the Army as a Surgeon or Veterinary Surgeon, but it is in all cases required of him that he should pass six months of his time in the ranks as a soldier.

The one-year volunteer in time of peace costs the State nothing. He has to supply himself with clothing from the regimental stores on payment of its value, and for the use of the necessary articles of equipment he is charged at a fixed rate. If mounted, the horse he rides is his own property and must be kept at his own expense, while everything spent on his own maintenance must come out of his own pocket. The sum ordinarily required amounts to about 105*l.* a year, but if from any cause a one-year volunteer, in the course of his year's service, finds himself unable any longer to pay his expenses, he may cease to be a volunteer and can become an ordinary soldier. Each month

which he has passed as a volunteer is then credited to him as three months ordinary service, and the time which he has to serve in the ranks to complete his time with the colours is calculated on this basis.

A one-year volunteer, after his twelve months are ended, passes into the reserve, having been given a certificate of qualification for the rank of Officer or non-commissioned officer, if while serving he has shown himself fitted to be something better than a private. When he obtains the certificate of Officer, he does not at once become a reserve Officer, but ranks only as a non-commissioned officer, and during the year following that in which he served with the colours, he must do duty as such, usually in his old corps. If after four weeks' duty as a non-commissioned officer he is considered by the commander fit to be an Officer, he is employed in this capacity for four weeks more, and if he passes this test satisfactorily he returns home and is eventually gazetted as a reserve Officer. When a one-year volunteer is desirous of being not merely classed a reserve Officer, but enrolled as a reserve Officer of the particular regiment in which he served, the examination as to his fitness is very stringent; as the Officers of the regiment take good care that a man who may thus join them for service in the field shall be thoroughly competent to take his place as their comrade. It should be observed that the fitness of any man to be a reserve Officer is determined not merely by his military attainments but also by his social qualifications, and that no one is accepted who is not considered satisfactory by the Officers of the *landwehr* battalion of his district.

The period of service in the reserve is the same for a one-year volunteer as for anyone else, viz., four years, after which he passes in the usual course into the *landwehr* and *landsturm*.

VIII.—MOBILIZATION.

Before explaining the steps by which the German Army is mobilized, it will be as well to set down clearly what is meant by this term. No army can be maintained at all times in a state of complete readiness for war, as the expense of permanently keeping up such quantities of draught animals, &c., as are necessary to make a modern army "mobile," would be beyond the resources of any nation. Moreover, as for garrison duty in time of peace a comparatively small force is required, while for modern warfare, at all events in countries where railways exist, armies cannot be too large, it follows that on passing from a peace to a war footing there must be a very great and very rapid expansion of the military force, which must necessarily involve such considerations as the clothing, arming, equipment, and general organization of the men thus added to the existing army, before the whole can be regarded as an efficient fighting machine. In this country, we have had no experience of mobilization. We have on various occasions called out our Reserves, but the wars in which they have been employed have been of a very different character from the life and death struggle to which the mobilization of a Continental Army is usually the prelude. How we should fare if required to carry out a real mobilization in the face of an imminent invasion is a question which it is not easy to answer satisfactorily, and therefore in speaking of mobilization as an abstract operation, we must simply regard the steps which must be taken by any Continental Power to prepare itself for a great war. These steps may be conveniently considered under two heads, viz.: those necessary for rendering the army of the first line ready for immediate service, and those necessary for creating troops of the second and third lines, and for defending the mother country.

To render the army of the first line fit to take the field, the cadres which exist in time of peace must be brought up to the war establishment, and certain new units must be formed. This involves the assembly of the reserve

men, who are living at home engaged in civil pursuits, arranging for sending them to join their corps, as well as clothing, equipping, and arming them on arrival.

Secondly, there is the formation of the staffs necessary for the army which is to take the field, as well as the large administrative staff required ; and

Thirdly, the army has to be supplied with horses.

In considering how far Germany is prepared to carry out these operations, the most important point to be observed is that each of the Army Corps of which her army consists is an absolutely independent unit, whose commander, on receipt of the orders to mobilize, can act without further reference to Berlin. By this system of decentralization whatever operations are required can go on simultaneously in each of the Army Corps districts, and the Army Headquarters in Berlin are left free for the transaction of more important business, confident that by a certain date the mobilization of every corps will be complete.

Completion of Cadres.—Turning now to the completion of the cadres from the reserves, which has been mentioned as the first step taken on the receipt of the mobilization orders, it is to be observed that in this respect Germany is advantageously situated. Her population is homogeneous, and tolerably evenly distributed, so that in each Army Corps district, the reserve men are at no very great distance from the centre at which they must report themselves. These centres are usually the headquarters of the landwehr district, but if it is considered that these places would become unduly crowded, the Army Corps Commander appoints additional rendezvous, which are notified to the Officers concerned. In all cases, however, the necessary arrangements are completed in time of peace, and as little as possible is left to be done under the strain and hurry of the mobilization. Thus the landwehr battalion commander has ready in case of need the *calling out* orders addressed to each individual reservist and landwehr man within the district, so that, on inserting the date, these orders specifying where the man is to report himself can at once be dispatched. Within twenty-four hours from the time when this order is received the man must be at the appointed rendezvous.

Before the men arrive at the rendezvous, however, each regiment sends a detachment¹ to this centre to receive the reservists, and pass them on by batches to the regimental headquarters. Here arms are kept in store for the regiment on a war footing, and from these stores the reservists are supplied, being afterwards furnished with clothing from the regimental clothing stores, in which perfectly new uniforms for the unit on war strength are always kept up.

The reservists who join each regiment or other unit are furnished from those who formerly served in its ranks, connection in peace-time being maintained by the rule, that all men while in the reserve are liable to be called out for two trainings of eight weeks each, these periods of training being passed with their old regiments at the time of the autumn manœuvres.

Comparing the peace and war strengths of the different units, it will be seen that the numbers which they have to receive on mobilization are as follows :—

| | | |
|----------------------------------|-----------|----------|
| Company of infantry..... | 1 Officer | 114 men. |
| Squadron of cavalry | — " | 24 " |
| Battery of field artillery | 1 " | 72 " |
| Company of foot artillery | 1 " | 86 " |
| " pioneers..... | 2 " | 94 " |
| " railway troops | 6 " | 104 " |

It will be noticed that the cavalry in Germany are much more rapidly

¹ Usually 1 Officer, 1 Surgeon, and 6 non-commissioned officers.

prepared for war than any other branch of the Service. By forming the fifth squadron into a *depôt*, they can take the field four squadrons strong at very short notice ; as the 96 men and 122 horses necessary to bring the four squadrons up to war strength might be supplied from the fifth squadron without waiting for the arrival of any reserve men. This, however, is not done under ordinary circumstances, it being considered sufficient that the cavalry should be ready to march on the third day of the mobilization.

Appointment of Staffs.—The second point which has been mentioned as a step in the mobilization of an army is the appointment of the staff. In Germany this is not left till war is imminent, but for every post which would have to be filled up on mobilization there is at all times an Officer nominated, so that when the occasion arises he at once steps into the place for which he has been selected, the duties of which have been perhaps for years the subject of his careful study.

It is needless to say that this does not apply to the staff of an Army Corps, Division, or brigade which is mobilized, as it is part of the system of the German Army that the staff of such units shall be composed in time of peace exclusively of those men who are best fitted to serve in the same capacities in time of war. Army Corps and Divisions, therefore, on mobilization take the field with exactly the same staff, with certain additions, which they have in peace, and at such a critical time as the outbreak of war there is no sudden or violent change in the system on which business is conducted.

Representative Administrations.—The departure, however, of the Army Corps with its entire staff would give rise to inconvenience in the transaction of business connected with the *depôt* and other troops remaining in the Army Corps district, and it is therefore provided that on mobilization the ordinary staff shall be at once replaced by what are called representative administrations. In each corps these are as follows :—

- The Corps Commander with Staff,
- 4 Infantry Brigade Commanders,
- The Inspector of *Depôt* Squadrons,
- The Commander of the Artillery,
- The Provincial Intendence with its branches.

The Officers who are to fill these various posts are all selected beforehand, and they commence work during the period of mobilization in order to become acquainted with their duties, but they do not exercise their functions actively till the Army Corps has moved off to the seat of war.

The staffs of such large units as Armies or cavalry Divisions which have no existence in time of peace must of course be assembled at the outbreak of war, but as the number and composition of the Armies which would be formed is dependent on the character of the enemy against whom hostilities are to be undertaken, and as the possible enemies of Germany are very few in number, the appointment of the staffs for the various cases is not a very complicated matter, and under any circumstances which may arise a complete staff is at all times ready for immediate service.

If the Officers selected for such duties are already holding commands or staff appointments, others hold dormant commissions to fill the posts which may thus be vacated, the Officers so chosen being generally taken from the half-pay or retired lists.

Supply of Horses.—The third point noted above is the supply of horses to the Army, and the steps necessary for carrying this out proceed simultaneously with the assembly of the men and the formation of the staffs. In order to form an idea of the magnitude of the operations involved in supplying the Army with horses to the extent required for service in the field, it may be mentioned that while in time of peace the number of horses maintained in

the Army is 96,000, the number required for war, supposing the whole of the military forces of the Empire to be mobilized, would amount to over 350,000, so that some 260,000 animals would have to be obtained. Of these, however, all would not be required at once on the outbreak of war, but even when those which can thus be dispensed with temporarily have been deducted, at least 150,000 must be found to meet the immediate necessities of the field troops. These horses are obtained by requisition, every animal in each district being enrolled and classed according as it is fit for riding or draught, and from these lists, which are revised every sixth year, the owners are summoned to send their animals to certain appointed centres for purchase by the military authorities. At each of these centres there is a Receiving Commission composed of one or two Officers, a veterinary surgeon, and some clerks,¹ and the horses presented are examined, and if considered suitable are purchased at a price determined by a Valuing Commission. As soon as the purchase is completed, the horses become the property of the State, and are handed over to the regimental escort parties who are waiting to receive them, as each regiment has assigned to it a definite centre where it is to obtain its horses in case of mobilization.

The numbers which the different units require to raise them from the peace to the war establishment are as follows :—

| | |
|----------------------------------|-----|
| Infantry battalion | 33 |
| Cavalry regiment..... | 122 |
| Battery of horse artillery | 154 |
| Field battery | 106 |
| Company of foot artillery | 6 |
| Company of pioneers | 18 |
| Company of railway troops | 28 |

The horse artillery is the arm which it is considered most important to supply with horses at the earliest date, so that it may accompany the cavalry Divisions to the front, and in case of necessity it is provided that these batteries should be supplied with horses from the field batteries of the same regiment, which have their deficiencies made good when the requisitioned horses begin to arrive. For the troops of the first line, it is considered that the necessary horses will arrive on the fifth day, and that within two days of their arrival they will be ready for any duty.

As improvements in the system are eagerly sought for, it is highly probable that on the next occasion on which the German Army is mobilized a considerable gain in rapidity will be noticeable; but as a proof of the excellence which was attained sixteen years ago, the following results of the mobilization of 1870 are interesting :—

| | |
|-----------------------------------|-----------------------|
| Infantry of the line | ready on the 8th day. |
| Guard | 10th |
| Cavalry | 3rd |
| Horse artillery | 3rd |
| Field artillery | 8th |
| Pioneers | 8th |
| Train (1st Section ²) | 10th |
| „ (2nd Section ³) | 18th |

The staff and military police, &c., were ready on the 8th day.

¹ These Receiving Commissions are detailed annually by the Corps Commander.

² Viz., 2 commissariat columns, 2 bearer companies, 4 field hospitals, and 1 bakery train for each Army Corps.

³ Viz., wagon-park columns and etappen columns.

In most cases the mobilization was very much facilitated by the circumstance that regiments drew both their reserve men and their horses from the district in which they were quartered, but in certain instances both had to join from a distance, and this must happen again to some extent unless, before the next German mobilization, Alsace and Lorraine have become thoroughly assimilated to the rest of the Empire. The great pressure on the railways, however, does not begin till after the corps are fully mobilized, when the strategic movement of the army to the theatre of war is commenced, and during the early days of the mobilization it would be quite possible for reserve men to move from one end of Germany to the other in nearly the same time that would be required for the journey under ordinary circumstances.

Strategic Concentration.—As soon as each Army Corps is fully prepared, it is sent forward to the theatre of war; by route march if the distance is short, and by train if it is more remote. Germany being well supplied with railways and rolling stock, there is at least one line of railway available for the conveyance of each corps in any given direction, and the strategic concentration of her armies can thus be carried out with the utmost regularity. The lines of railway which are used for the conveyance of the fighting units in the first instance serve afterwards for the supply of the corps, and the removal of its sick and wounded, a convenient station within the Army Corps district being established as a military traffic centre, to and from which all military trains proceed.

Having considered the steps necessary for placing the first line army in the field, we may turn to the other steps necessary for a general mobilization, viz., the formation of reserve and depot troops, and the armament of the fortresses.

Reserve Troops.—The term reserve troops includes the landwehr, the reserve rifle companies, reserve cavalry regiments, the reserve batteries, and, where they are not required with the Army Corps, the foot artillery regiments and pioneer companies. These troops, as a rule, are employed to garrison fortresses, to defend the line of communications, and to keep order within the Empire, but if necessary they can be pushed forward to reinforce the field army.

Landwehr.—The landwehr, as has been mentioned already, is a territorial force, in some respects resembling our militia, but composed exclusively of men who have already served in the ranks of the Army, and who are on the average about thirty years old. In time of peace only small cadres are kept up, and these are exclusively for the infantry,¹ but in time of war, units of cavalry, artillery, pioneers, and train are formed as well as infantry.

There are generally seventeen landwehr battalion districts for each German Army Corps, two such districts corresponding to each infantry regiment in the corps, and one district being in reserve. In the case of the large towns of Berlin, Breslau, and Cologne, these form reserve landwehr regiment districts, Berlin furnishing 4 battalions, and the others 2 each. The total number of landwehr battalions which could be thus raised would amount to 280, to which, however, must be added 18 battalions for the 9 regiments of Guard infantry, which have no recruiting districts, and two more for the 109th Baden Grenadiers, which is likewise without a district, so that the total number of landwehr battalions available would amount to 300.

There are two establishments for a landwehr battalion on war strength,

¹ At landwehr battalion headquarters, 1 Field Officer in command, 1 Lieutenant attached from the corresponding infantry regiment, 1 clerk, and 2 orderlies. In each company district there is also a district sergeant-major, a non-commissioned officer, and a private: total, 2 Officers and 15 men.

viz., 22 Officers and 802 men, and 22 Officers and 1,002 men; the latter being adopted when the magnitude of the struggle in which the country is engaged renders it necessary.

Fourth Battalions.—There is a further reserve of infantry for which no cadres are maintained, and of which no mention is made by the Germans, but which is recognized by French critics as likely to have a very real existence in the next war in which Germany is engaged. This force consists of the fourth battalions, which it is assumed would be raised in some or all regiments as soon a mobilization is ordered, and the grounds on which this assumption is based are as follows:—As the number of recruits which each infantry battalion receives annually is 190, the number received by the regiment is 570, and at any time there are 12 contingents available, viz., 3 in the ranks, 4 in reserve, and 5 in the landwehr. The total number would thus be 570×12 or 6,840, or, allowing for the normal decrease, 6,143. If from these only 3 battalions of the first line (at 1,026 each) and 2 battalions of landwehr (at 824 each) were formed, there would remain 1,417 thoroughly trained soldiers still available. It is known that it is the intention to fill up the *depôt* battalions, which will presently be mentioned, to a considerable extent with men of the *Ersatz Reserve*, and as it is not likely that such a large body of trained soldiers would be left unemployed, it is considered that they would be formed into fourth battalions. If each regiment, however, were to raise a fourth battalion of the usual strength, the surplus remaining out of the twelve contingents would only be 391, and this would leave such a very small margin that it is considered probable that each regiment will only raise a half battalion. This view is supported by the fact that each regiment has in reserve clothing and equipment for two companies (see page 327), and there would therefore be no difficulty in the formation of these half battalions, whose number is calculated at 140,¹ thus furnishing, if necessary, 23 additional regiments of three battalions each.

Reserve Rifle Companies.—In addition to the landwehr infantry of the line there are reserve rifle companies to the number of one for each rifle battalion. These reserve rifle companies have no existence in time of peace, but the clothing and equipment necessary for them are kept at the headquarters of the battalion. When required for service the men are obtained from the reservists or landwehr men who formerly served in the rifle battalion, and should it be considered desirable to form them into reserve rifle battalions, four of the companies are combined for this purpose.

Reserve Cavalry Regiments.—It has been already mentioned that the fifth squadron of a German cavalry regiment becomes the *depôt* on mobilization, and in connection with every such *depôt* squadron one or two reserve squadrons are formed from the reservists and landwehr men who are available after the service squadrons have been brought up to war strength. Clothing, equipment, and saddlery for these squadrons are kept with the regiment in time of peace, and are issued by the *depôt* squadron on mobilization. The reserve squadrons, when organized, are formed into reserve cavalry regiments, each of four squadrons, and as the normal number of line cavalry regiments in an Army Corps district is five, it may be assumed that the number of reserve squadrons will be from eight to ten, and that on the average two reserve regiments will be formed in each Army Corps district.

Reserve Batteries.—The corps artillery regiment in each Army Corps forms on mobilization three or four reserve batteries, which constitute the Divisional artillery of the reserve Divisions. The *matériel* necessary for these batteries

¹ As the Guards mobilize a double force of landwehr, it would not be possible for them to form fourth battalions.

is kept in time of peace at the headquarters of the artillery regiment, and is identical with that of ordinary field batteries. The men are obtained from the reserve and landwehr, Officers and non-commissioned officers being to some extent supplied from the *depôt* batteries or detachments.

Reserve Pioneers.—Reserve pioneers are formed in a similar manner on mobilization in the proportion of a reserve company to each pioneer battalion, the miner company having the duty of forming this unit.

Reserve Train.—A train, in its general organization resembling that of the regular troops, is also attached to each reserve infantry Division (see page 350).

Depôt and Garrison Troops.—The whole of the units of the landwehr may be employed in guarding the lines of communication of the field army, in holding entrenched camps within the frontiers of the home country, or in occupying captured fortresses in the enemy's territory, so that to provide for the filling up of the vacancies which occur in ranks of the field troops, recourse must be had to the special formations known as *depôt* and garrison troops. The rule adopted is that when any unit of the field army is more than 5 per cent. below its establishment, a requisition is sent to the *depôt*, and as an instance of the extent to which the *depôts* were drawn on during the war with France, it may be mentioned that up to the beginning of March, 1871, 2,172 Officers, 222,590 men, and 22,012 horses were supplied to the field army from these sources.

Infantry Depôts.—*Depôts* are formed on mobilization in every branch of the service, that for a regiment of infantry consisting of a battalion with a normal strength of four companies. The *depôt* battalion of each regiment of the Guards has, however, five companies, and in the line whenever a *depôt* battalion has a strength of more than 300 men above the four company establishment, these supernumeraries are formed into a fifth company.

The Officers required for these *depôt* battalions are furnished partly from the corresponding regiment of the active army, and partly from reserve and landwehr Officers. In 1870–71 on the average there were 7·7 Officers from the active army in each *depôt* battalion, and 6·5 Officers of reserve and landwehr, the remainder of the Officers' posts in the battalion being filled by non-commissioned officers.

A *depôt* battalion of the line with four companies would have the following establishment:—

| | | | |
|---|---|---|--------------------|
| Officers | { | Battalion staff | 2 |
| | | Company | 16 |
| | | In charge of tradesmen | 1 |
| Non-commissioned officers and men..... | { | Non-commissioned officers and recruits | 1,004 ¹ |
| | | Tradesmen's section | 211 ² |
| | | | |
| Medical Officers | | | 2 |
| Paymasters | | | 2 |
| Armourers | | | 1 |
| | | | 1,239 |

The recruits are obtained by calling up men on furlough, Ersatz Reserve men, and men of the landwehr, as the needs of the Service may require, and any annual contingents which may become available during the continuance of the war would of course join the *depôts* for instruction before being sent on to the units in the field. At the commencement of the war with France, the first casualties in the German Army, occurring during August and Sep-

¹ 400 of these are drawn from the 1st class of the Ersatz Reserve.

² 11 non-commissioned officers, 100 tailors, and 100 shoemakers.

tember, 1870, were replaced by thoroughly trained soldiers, of whom there were about 500 in each battalion, and the men next sent forward consisted of volunteers and Ersatz Reserve men, incorporated at the time when the mobilization of the Army was ordered. These sufficed to meet the requirements of the field troops up to the beginning of 1871, when the young men forming the contingent of 1871 who had joined during the previous autumn began to be available.

Garrison Battalions.—In every brigade district a special battalion is formed on mobilization, which is called a garrison battalion, and consists of four companies. The function of this battalion is to act as a *depôt* for the corresponding landwehr regiment, in the same way as the *depôt* battalion serves for its regiment in the first line. These garrison battalions have an effective of 22 Officers, 2 Surgeons, 1 Paymaster, 1 armourer, and 1,006 non-commissioned officers and men, the Officers being mainly drawn from the landwehr, and the men being furnished almost exclusively from the Ersatz Reserve. The Guard landwehr regiments, for which no garrison battalions are raised, draw their recruits from the 5th companies of their *depôt* battalions, which are maintained for this special purpose.

Depôt Squadrons.—The squadron of a cavalry regiment left behind as a *depôt*, on mobilization has the following establishment:—

| | |
|---|-----------|
| Officers | 5 |
| Non-commissioned officers and men | 201 |
| Medical Officers..... | 1 |
| Paymasters..... | 2 |
| Veterinary surgeons | 1 |
| | <hr/> 210 |

with 212 horses. In any Army Corps district where the number of cavalry reserve men is more than sufficient to meet the requirements of the cavalry and of the train, one or more dismounted or garrison squadrons are formed, but these would probably in the course of the war either be supplied with horses and used as cavalry, or employed at the *depôts* of horses which would be formed within the district.

Artillery Depôts.—Each regiment of field artillery forms on mobilization a *depôt* detachment, consisting of a staff, two batteries of six guns each, and a tradesmen's section. The detachment formed by the Divisional regiment of each corps has two *depôt* field batteries, but the detachment formed by the corps artillery regiment has one *depôt* field battery and one *depôt* horse artillery battery.

The establishments of these are as follow:—

| | Field battery (divisional regiment.) | Field battery (corps art. regiment.) | H. A. battery. |
|---------------------------------------|---|---|-------------------|
| Officers | 4 | 4 | 4 |
| Non-commissioned officers and men ... | 165 | 215 | 139 |
| Horses..... | 68 | 68 | 118 |

The foot artillery regiments form on mobilization thirty-one landwehr battalions, corresponding to the thirty-one Guard and line battalions constituting

this force, and for each mobilized foot artillery battalion a park company is organized. The landwehr battalions serve as dépôts to their corresponding battalions of the first line, and have approximately the same establishment.

Pioneer Dépôts.—Each battalion of pioneers forms a dépôt company on mobilization, with a tradesmen's section attached. The company has a strength of 4 Officers and 262 non-commissioned officers and men, with a Surgeon, an hospital assistant, and 2 Paymasters, while the tradesmen's section is composed of 5 non-commissioned officers and 70 men.

Railway Troops Dépôt.—The railway regiment forms on mobilization a dépôt detachment of two companies, with an artizans' section, the dépôt detachment having a strength of 16 Officers and 410 non-commissioned officers and men, with a surgeon, 2 hospital assistants, and 3 Paymasters, and the artizans' section, 1 Officer and 106 non-commissioned officers and men.

Train Dépôts.—Each of the eighteen train battalions forms on mobilization a dépôt detachment, consisting of a staff, two companies, and a train dépôt, with a tradesmen's section. The detachment has a strength of 12 Officers, 502 non-commissioned officers and men, with 9 non-combatants, 211 horses, and 40 vehicles, and the tradesmen's section, 1 Officer and 127 non-commissioned officers and men.

Horse Dépôts.—In each Army Corps district a stationary dépôt of horses, to the number of 300, is formed to receive the animals obtained by purchase or requisition, to forward them to the movable horse dépôts which follow the field army, and to provide for unforeseen casualties. Two central horse dépôts are also provided, each for 500 horses, so that if these dépôts are maintained at their full establishment a reserve of over 6,000 horses would always be available in Germany, exclusive of the animals which might be obtained in the immediate neighbourhood of the operations.

Arming of the Fortresses.—With regard to the remaining step in the mobilization of the German Army, viz., the arming of the fortresses, it is only necessary to observe that the points of attack having all been very carefully considered in peace-time, the proper measures of defence are promptly adopted, and in those fortresses which are on the frontier or otherwise liable to early investment, special precautions are taken that the troops forming their garrisons shall receive their reserve men at the earliest moment, so that there shall be no risk of their being shut out by the advance of the enemy. In all fortresses there is an extensive network of subterranean telegraphic communication, both with the rest of the Empire and between the various portions of the defensive system. For each detached work a Commander is nominated in time of peace, and all details of the garrison required, the supply of provisions, ammunition, and stores, have been most carefully worked out, the principle in this, as in all else connected with the German mobilization, being, that so far as is possible, everything which can occur is foreseen, and that nothing which can be settled beforehand is left to be decided in the hurry of imminent war.

The following are the most important of the German fortresses :—

On the side of the Netherlands, Belgium, and France :

Wesel, Cologne,¹ Coblenz, Mayence, Metz,¹ Gernersheim, Rastatt, and Strasburg.¹

On the side of Switzerland and Austria :

Ulm, Ingolstadt,¹ Neisse, and Glogau.

On the side of Russia :

Posen,¹ Thorn,¹ Königsberg,¹ and Danzig.

In the interior of the Empire are Magdeburg, Custrin, and Spandau, and on the Baltic and North Sea there are numerous fortified harbours, of which the most important are Kiel, Friederichsort, and Wilhelmshaven.

¹ Surrounded by a girdle of detached forts.

IX.—THE ARMY ON A WAR FOOTING.

In the previous section the steps have been mentioned by which the units of the German Army are raised from peace to war strength, and it now remains to consider the Army as it might stand when completely ready for action. It has been seen that the principles which are observed in fitting the Army for active service are, that as little as possible is left to be done when war is imminent, and that, as far as can be, that organization is preserved under which the troops have been serving in time of peace.

The Brigade.—The increase which takes place in the establishment of regiments involves no alteration in their organization, and in the next larger unit, the brigade, the changes only affect the cavalry. Troops as a rule take the field as part of the same brigade to which they belong in time of peace, and continue to serve under the same Brigade Commander, who is assisted by the same Staff Officer.

Infantry Brigade.—An infantry brigade consists ordinarily of two infantry regiments, and though in time of peace some brigades have three regiments, it may be considered that two is the normal establishment which would be maintained in time of war. An infantry brigade on war strength would therefore stand as follows:—

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|---------------------|-----------|-----------|-------|---------|---------|
| Staff..... | 1 | 1 | 10 | 14 | 1 |
| 2 Regiments | .. | 158 | 6,224 | 270 | 56 |
| Total..... | 1 | 159 | 6,234 | 284 | 57 |
| 6,394 of all ranks. | | | | | |

The six battalions of which the brigade consists would furnish 6,144 combatants, of whom 5,856 would be armed with rifles, for each of which 112 rounds are carried.

Cavalry Brigade.—The number of regiments in a cavalry brigade in time of peace varies from two to four, but it may be assumed that in time of war all cavalry brigades would have the normal establishment of two regiments; the extra regiments which would thus become available being attached to the various infantry Divisions as Divisional cavalry.

A cavalry brigade would thus stand as follows when on war strength:—

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|---------------------|-----------|-----------|-------|---------|---------|
| Staff..... | 1 | 1 | 10 | 14 | 1 |
| 2 Regiments | .. | 56 | 1,312 | 1,472 | 16 |
| Total..... | 1 | 57 | 1,322 | 1,486 | 17 |
| 1,380 of all ranks. | | | | | |

The eight squadrons of which the brigade is composed would furnish 1,253 mounted combatants, of whom 1,056 would be armed with carbines, for each of which 50 rounds of ammunition is carried.

Infantry Division.—An infantry Division when on war strength varies from the peace establishment both in the increased size of the units composing it, and in the new formations which are called into existence on mobilization; but in its general organization it is merely a development of what has existed in peace-time, and is in no respect a new formation. It takes the field with its own commander and its own staff, and the troops comprising it are exclusively those which are permanently associated with it, and between whom there is a bond of union.

Its war strength would be as follows :—

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|---------------------------------|-----------|-----------|--------|---------|---------|
| Staff | 1 | 29 | 71 | 79 | 10 |
| 2 Infantry brigades..... | 2 | 318 | 12,468 | 568 | 114 |
| 1 Cavalry regiment | .. | 28 | 656 | 736 | 8 |
| 1 Field artillery detachment .. | .. | 25 | 696 | 618 | 75 |
| 1 Pioneer company | .. | 6 | 214 | 19 | 4 |
| 1 Divisional bridge train... .. | .. | 2 | 52 | 88 | 14 |
| 1 Bearer company | .. | 12 | 240 | 47 | 13 |
| Total..... | 3 | 420 | 14,397 | 2,155 | 238 |
| 14,280 of all ranks. | | | | | |

The 12 battalions of infantry, 4 squadrons of cavalry, and 4 batteries of artillery composing the Division would furnish 12,292 infantry combatants, 624 cavalry combatants, and 24 guns. As mentioned already there is no Divisional ammunition column, and therefore the number of rounds per rifle is the same as that which under ordinary circumstances is carried with a battalion, but in the event of a Division being employed independently, one of the corps ammunition columns would be specially detailed to accompany it.

Cavalry Division.—The cavalry Division being an organization which, except in four instances, does not exist in Germany in time of peace, these units have to be formed as soon as a mobilization is ordered. Although this departure from the custom prevailing in the other branches of the service might seem less suited to the prompt employment of cavalry on the outbreak of war than the Russian plan by which all regular cavalry regiments are permanently united into cavalry Divisions, yet the Germans doubtless consider that with their admirable railway communications they can assemble their cavalry wherever it may be required, in a sufficiently short space of time, and regard whatever drawbacks there may be in their system as more than counterbalanced by the advantages of maintaining thoroughly the principle of localization.

Cavalry Divisions were employed independently in advance of each of the German Armies in the invasion of France in 1870,¹ and it is from the experience of that war, that the normal composition of a German cavalry Division on war strength must be deduced. It would therefore in all probability stand as follows :—

¹ When the war commenced, the 3rd Cavalry Division (16 squadrons and 1 battery) covered the advance of the 1st Army; the 5th, and 6th Cavalry Divisions (56 squadrons and 3 batteries) covered the advance of the 2nd Army, and the 4th Cavalry Division (24 squadrons and 2 batteries) covered the advance of the 3rd Army.

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|--|-----------|-----------|-------|---------|---------|
| Staff..... | 1 | 28 | 71 | 79 | 10 |
| 3 Cavalry brigades (24 squadrons) | 3 | 171 | 3,966 | 4,458 | 51 |
| 1 Horse artillery division (3 batteries) | .. | 20 | 505 | 708 | 57 |
| 2 Ammunition wagons | .. | — | 7 | 13 | 2 |
| Total | 4 | 219 | 4,549 | 5,258 | 120 |
| 4,772 of all ranks. | | | | | |

The 24 squadrons of cavalry and 3 batteries of horse artillery which form the fighting strength of a German cavalry Division would furnish respectively 3,754 mounted combatants and 18 guns, 50 rounds per carbine being carried by each man, with 10 additional rounds in the ammunition wagons.

In case of a cavalry Division being employed independently it might be accompanied by a mounted bearer detachment furnished from the Army Corps which are in rear, but otherwise must be entirely dependent on the regimental surgeons and hospital assistants for whatever medical or surgical aid may be required.

As the destruction of railways is a very important part of the duty of a cavalry Division covering the advance of an invading army, each squadron is supplied with a set of light tools specially adapted to this object, while two spare sets and two similar sets of heavy tools for more serious demolitions are carried as a reserve.

The Army Corps.—The Army Corps, which is the largest unit existing in time of peace, receives on mobilization a considerable development, but as in the Division, the changes which are made do not affect its general organization.

The Army Corps when on war strength would stand as follows :—

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|--|-----------|-----------|--------|---------|---------|
| Headquarters Staff | 2 | 48 | 224 | 252 | 20 |
| 2 Infantry Divisions | 6 | 849 | 28,794 | 4,310 | 476 |
| 1 Rifle battalion..... | .. | 25 | 1,031 | 40 | 12 |
| Corps artillery | .. | 54 | 1,393 | 1,250 | 151 |
| 10 Ammunition columns .. | .. | 33 | 1,782 | 1,818 | 256 |
| 1 Pioneer company | .. | 6 | 214 | 19 | 4 |
| 1 Corps bridge train | .. | 7 | 191 | 225 | 33 |
| Train battalion (forming 5 commissariat and 5 wagon park columns, the field bakery, horse depôt, 12 field hospitals, and a bearer company) | .. | 149 | 2,330 | 2,531 | 664 |
| Total | 8 | 1,167 | 35,959 | 10,445 | 1,616 |
| 37,134 of all ranks. | | | | | |

The 25 infantry battalions, 8 squadrons of cavalry, and 16 batteries of artillery in an Army Corps give a fighting strength of 25,620 infantry combatants, 1,248 cavalry combatants, and 96 guns. For each infantry rifle there are 172 cartridges provided, and for each cavalry carbine 74, while 256 rounds are carried for each field battery gun, and 288 for each horse artillery gun. There are the means of carrying 8 days' food for each man in the Army Corps, forage for 7 days for all riding, and 9 days for all draught horses.

With regard to the medical establishment of an Army Corps, there is one surgeon to every 203 men of the gross total and one to every 150 of the fighting strength, while the medical assistants, men of the bearer companies, &c., are in the proportion of 1 to every 28 men of the gross total, and 1 to every 20 men of the fighting establishment.

From what has been stated above it will have been seen how carefully the requirements of an Army Corps for service in Europe have been provided for, and all will recognize the merits of the system by which the German Army Corps can be sent on active service under its own Commander, with no more trouble than is required for the despatch of the battalion, cavalry regiment, or battery, which are the largest units to which the orders of our Commander-in-Chief are ordinarily conveyed.

The Army.—It has been already mentioned that the German Army has eighteen Army Corps similar in composition, with one independent infantry Division (the Hessian), and these corps are in time of war combined to form Armies. The strength of an Army varies according to the circumstances of the campaign, but it may be taken as a rule to be composed of from two to four Army Corps.¹ The staff of an army is naturally dependent on the number of Army Corps of which it consists, and is therefore not laid down, being assembled only when war is inevitable, but those who are to occupy important posts are designated for them beforehand, and by the time the mobilization of the various Army Corps is complete, the superior directing staff is certain to be in working order.

At the head of all, controlling the Commanders of the different Armies, is the Sovereign, with the Great General Staff, established either at Berlin or at some advanced station, as the progress of the campaign may render desirable.

Such is the German Army of the first line, which would have the following total available war strength :—

| Generals. | Officers. | Men. | Horses. | Wagons. |
|-----------------------|-----------|---------|---------|---------|
| 223 | 26,900 | 794 000 | 254,500 | 32,400 |
| 821,123 of all ranks. | | | | |

Taken according to the arms of the Service there would be 503 battalions of infantry, 203 companies of engineers and foot artillery, 465 squadrons of cavalry, and 340 batteries of artillery.

Before considering the army of the second line, to which the duty of home defence would presumably be confided, the organization of the line of com-

¹ In 1866 two armies were formed, the first consisting of three corps and the second of four. In 1870 the campaign was commenced with three armies, of which the first had two corps, the second four, and the third four, with two independent Divisions.

munications must be taken into account, as the troops required for this service may be furnished either from those of the first line or from those of the second.

Etappen Inspections.—For each separate army which is constituted in time of war an *etappen* inspection is formed, and this department has the duty of forwarding to each Army Corps in the field the supplies of all kinds which the military authorities in the corresponding Army Corps district wish to send to the front, while it at the same time relieves the corps of all sick, wounded, and prisoners whose presence would tend to impair its efficiency.

Each *etappen* inspection has the following establishment:—

1 Lieut.-General (*Etappen Inspector*) with 6 train soldiers, 10 horses, and one 4-horse wagon.

1 Staff Officer with 4 train soldiers, 8 horses, and one 4-horse wagon.

3 Adjutants¹ with 3 train soldiers and 6 horses.

1 Paymaster, with 1 man and 1 horse.

1 Senior veterinary surgeon with 1 man and 1 horse.

2 Veterinary surgeons with 2 horses.

5 Mounted orderlies with 5 horses.

13 Dismounted orderlies.

4 Non-commissioned officers as clerks.

3 Farriers.

The other branches of the *etappen* inspection are as follows:—

Military Police: 1 Captain, 1 sergeant-major, a number of privates varying with the strength of the army,² 4 train soldiers, with 6 horses and a 2-horse wagon.

Intendance: 24 officials, 42 men, 54 horses, and 7 wagons (three 4-horse, four 2-horse).

Medical: 1 Surgeon-Major, 1 assistant surgeon, 4 men, 5 horses, and a 2-horse wagon.

Legal: 1 *etappen* auditor, with 1 clerk, 2 men, 2 horses, and a 2-horse wagon.

Telegraph Service: 1 *etappen* Telegraph Director, with 3 Inspectors, 8 men, 10 horses, and four 2-horse wagons.

Postal Service: 1 Army Postal Director, with 3 Inspectors, 6 men, and 8 horses.

Civil Administration: 1 senior civilian official, with 1 police official, 3 men, 4 horses, and a 2-horse wagon.

The *etappen* inspection for each army thus consists of at least 178 men, 122 horses, and 17 wagons, and all such inspections are controlled by the Inspector-General of the *Etappen*, who is in direct communication with the Great General Staff. The Staff of the Inspector-General of *Etappen* amounts in all to 104 men, with 108 horses, and 15 wagons, and includes representatives of the legal department, the intendance, the medical, the telegraph and the postal services, as well as a special staff for field railway work.

Second Line Troops.—The troops of the second line are furnished by the *landwehr* as already explained (page 305), and these are organized in a manner similar to that adopted by the first line, except that there is no unit of reserve troops larger than the Division.

Reserve Infantry Brigade.—The *landwehr* battalions for which cadres are maintained in time of peace are formed on mobilization into *landwehr* regiments of three battalions each, and two such regiments constitute a reserve brigade, the establishment of which will be as follows:—

¹ A Captain of artillery, a Captain of engineers, and a Lieutenant.

² In the proportion of 20 for each Army Corps of which the army consists.

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|---------------------|-----------|-----------|-------|---------|---------|
| Staff | 1 | 1 | 10 | 14 | 1 |
| 2 Regiments | .. | 156 | 5,002 | 268 | 56 |
| Total | 1 | 157 | 5,012 | 282 | 57 |
| 5,170 of all ranks. | | | | | |

The 6 battalions of which the brigade consists would furnish 4,954 combatants, of whom 4,664 would be armed with rifles.

The number of landwehr infantry brigades which could be formed in each Army Corps district amounts as a rule to three,¹ but as each district would presumably only mobilize one reserve Division, a considerable force of landwehr infantry would remain to be disposed of, and these troops, amounting to eighty-three battalions, would be available for employment wherever they might be most required.

Reserve Infantry Division.—A reserve infantry Division has a composition generally similar to that of a Division of the first line ; with the addition of certain units which there form part of the Army Corps establishment. Its war strength is as follows :—

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|---|-----------|-----------|--------|---------|---------|
| Staff | 1 | 29 | 71 | 79 | 10 |
| 2 Reserve infantry brigades | 2 | 314 | 10,024 | 564 | 114 |
| 1 Reserve cavalry regiment | .. | 28 | 656 | 736 | 8 |
| 1 Reserve field artillery detachment ² | .. | 20 | 526 | 468 | 55 |
| 1 Reserve pioneer company | .. | 6 | 214 | 19 | 4 |
| 2 Reserve infantry ammunition columns | .. | 6 | 348 | 350 | 43 |
| 1 Reserve artillery ammunition column | .. | 7 | 189 | 197 | 28 |
| 1 Reserve bearer company. | .. | 12 | 240 | 47 | 13 |
| 3 Reserve field hospitals .. | .. | 24 | 144 | 96 | 18 |
| 2 Reserve commissariat columns | .. | 6 | 230 | 334 | 64 |
| Total | 3 | 452 | 12,642 | 2,890 | 362 |
| 13,097 of all ranks. | | | | | |

The twelve battalions of which the reserve infantry Division consists may be increased, if considered desirable, by a reserve rifle battalion formed as already mentioned from the reserve rifle companies which are raised on mobilization, but as this additional battalion is not a necessary part of the infantry Division it has not been included above. The total fighting strength of a reserve infantry Division would thus be 12 battalions, or

¹ The IXth, Xth, XIIIth, and XIVth Army Corps districts furnish rather less.

² 3 batteries, but in some cases 4.

9,912 infantry combatants ; 4 squadrons or 624 mounted combatants, and 3 or 4 batteries of artillery (18 or 24 guns) with the small force of pioneers.

For each Army Corps of the first line there would be a reserve Division constituted as here shown, and in addition there would remain for disposal a considerable force of landwehr of all arms, being the surplus after the formation of the eighteen reserve Divisions. The numbers of the landwehr troops, considered under these two heads, would be as follows :—

| | Generals. | Officers. | Men. | Horses. | Wagons. |
|------------------------------------|-----------|-----------|---------|---------|---------|
| 18 Reserve infantry Divisions..... | 54 | 8,136 | 227,718 | 52,020 | 6,516 |
| Surplus | .. | 6,147 | 207,645 | 11,025 | 2,538 |
| Total | 54 | 14,283 | 435,363 | 63,045 | 9,054 |

Third Line Troops.—The German troops of the third line consist of the landsturm, but as the men of this category have never yet been called out, the strength of the military force which might thus be supplied must remain a matter of conjecture. The total number of men liable for service as members of the landsturm is, however, very large, being no less than 3,634,210 in the year 1880, but if only those are considered who have passed through the ranks of the regular army and the landwehr, and who are still fit for service, the number of such men thoroughly trained, and not exceeding 42 years of age, is estimated at 965,000, from which at a very moderate computation 300 regiments of infantry and 100 regiments of cavalry might be formed.

The numbers of the troops mentioned above as comprising the force which Germany could put in the field, if it were requisite to employ the whole of her military resources, would be approximately as follows :—

| | |
|------------------------------|-----------------------|
| 1st line troops | 821,120 of all ranks. |
| 2nd " | 449,700 " |
| 3rd " (landsturm)..... | 965,000 " |
| Total..... | 2,235,820 |

To these, however, must be added the strength of the dépôt and garrison troops already referred to, and these would stand as follows :—

| | | |
|-------------|-------------------------------------|-----------------------|
| Infantry { | 161 dépôt battalions | 199,479 of all ranks. |
| | 66 garrison battalions | 67,496 " |
| | 20 dépôt rifle companies | 5,140 " |
| Cavalry, { | 93 dépôt squadrons..... | 19,530 " |
| | 74 dépôt batteries | 13,367 " |
| Artillery { | 31 foot landwehr battalions | 19,809 " |
| Pioneers, { | 42 dépôt and fortress companies.... | 8,652 " |
| Train, { | 18 train detachments | 9,252 " |
| | | 342,725 " |

thus making a total of 2,578,545 of all ranks.

If we put on one side the landsturm, and consider only the available resources of the Empire in men between the ages of 20 and 32, it becomes interesting to note what proportion the total of 1,613,535 who compose the German Army on a war footing bears to the number of those who have been

actually trained as soldiers. Counting men in the ranks and those belonging to the reserve and the landwehr, 12 annual contingents will be available, i.e., $12 \times 150,000$ or 1,800,000, less an allowance for the normal decrease. The average decrease has been calculated to be 5·4 per cent., and after making this deduction it appears that 1,702,800 thoroughly trained men will be available. But in addition to these men the German Government can draw on the Ersatz Reserve, and though the bulk of these men have had no military instruction, the number of those partially trained, under the system introduced in 1881, already amounts to about 100,000, and is increasing every year. The maximum will not be reached till 1893, but after that date the German Government will be able to count on obtaining from this source at least 200,000 men with some military knowledge.

Thus it appears that without counting the untrained men of the 1st class of the Ersatz Reserve, who must number nearly 200,000 more, the system in force in Germany will provide 1,900,000 trained men to fill up the cadres of an army which on war strength amounts to something over 1,600,000. The further reserves of men which might be drawn on in case of a great national emergency are the 2nd class of the Ersatz Reserve and the landsturm.

X.—CLOTHING, EQUIPMENT, AND ARMS.

Before entering on any description of the clothing of the German soldier, it may be as well to remark briefly on the system by which clothing and equipment are supplied. In Germany there is no great central clothing department, but everything connected with the supply of uniform is left absolutely in the hands of the regimental Officers. In each regiment, the Colonel is held responsible that his men are properly clothed and equipped, but the machinery by which this result is obtained is a Board of Officers who attend to the details. This Clothing Board (*Bekleidungs Kommission*) is generally appointed annually, and consists of five members, viz., a Field Officer as President, a Captain, two Lieutenants, and a Paymaster. In infantry regiments there is also a Battalion Clothing Board in each battalion, consisting of a Captain as President, and a Lieutenant and the Paymaster as members. These Boards receive the money allowance granted to the unit, and with the approval of the regimental commander enter into contracts for the purchase of materials, and arrange for the making-up of the uniforms in the regimental workshops. The money allowance has been calculated with extreme nicety, so that the most rigid economy is necessary to bring the cost of the articles produced within the grant, and leave a balance to be added to the clothing fund; but from the fact that the headquarters of a regiment are always established at the same place, contracts can be obtained on favourable terms, and the materials are made up by the tradesmen attached to the regiment, and, if extra hands are required, by the wives of the non-commissioned officers, who are paid at a low rate.

The clothing when completed is put in store, there being rooms provided for this purpose, for each company, squadron, battalion, or regiment.

The company or squadron store contains ordinarily three complete suits for every man of the peace establishment, viz., the war uniform (*kriegs-garnitur*) which is only issued on mobilization, the parade uniform (*parade-garnitur*) which is worn on State occasions, and the Sunday uniform (*Sonntag's-garnitur*) in which the troops appear on Sundays and at inspections.

The battalion store, or the corresponding store for each artillery division, contains a complete outfit of clothing and equipment for every man required to raise the unit from the peace to the war establishment.

The regimental store consists of four branches, viz., (1) the regimental depôt store, (2) the landwehr regiment store, (3) the landwehr depôt store, and (4) the reserve store.

(1) The regimental *dépôt* store contains complete stores for the *dépôt* battalion (or other corresponding formation) which is raised on mobilization.

(2) The landwehr regiment store has similar stores for the landwehr battalions, &c., when called up.

(3) The landwehr *dépôt* store is in the same way calculated for the requirements of the landwehr *dépôt* battalion, or garrison battalion.

(4) The reserve store is for the purpose of meeting unforeseen demands, and contains all that is necessary for two companies on war strength.

The number of outfits which are thus permanently maintained in each German infantry regiment are sufficient for $7\frac{1}{2}$ battalions on war strength,¹ and if we add the four or five suits which are kept for each man on the peace establishment, we arrive at a total of from 10,000 to 12,000 uniforms in possession of each regiment.

Infantry.—The following are the articles of clothing and equipment of a German infantry soldier for service in the field.²

Clothing.—1 forage cap with cockade, 1 tunic, 1 neckcloth, 1 pair cloth trousers, 1 pair linen trousers, 1 pair drawers, 1 great-coat, 1 pair cloth ear flaps, 1 pair boots, 1 pair shoes, 1 pair half-soles, 2 shirts.

Equipment.—1 helmet, 1 knapsack and straps, 1 waist-belt and plate, 1 great-coat strap, 1 havresack, 1 flask, 1 sword-knot, 2 cartridge pouches, 1 rifle-sling, 1 box of spare parts for rifle, 1 grease-box, 1 canteen and straps, 1 bag to hold rice, 1 bag for coffee, 1 bag for salt.

Miscellaneous Articles.—1 bag containing bandages (carried in the trousers pocket), 1 mark of identity, and in some cases a small coffee-mill, of which 52 per battalion are carried distributed among the men.

The mark of identity is a small tin label worn round the neck, and stamped with the number of the man's regiment, squadron, or company, as well as with his own regimental number.

Tools.—The tools which are carried with a battalion are as follows :—

Carried by the men :—400 small spades.
40 pickaxes.
20 hatchets.

Carried in the wagons :— 54 large spades.
18 mattocks.
12 axes.
27 hatchets.

Regimental Distinctions.—The distinctive characteristics in the uniforms of infantry regiments are to be found in the colours of the lace, the facings, and shoulder-straps, and in the numbers or initials on the shoulder-straps.

It was formerly possible to ascertain by the colour of the shoulder-straps the Army Corps to which a man belonged, certain colours having been adopted by certain corps, but since the formation of the XVth Corps there have been a considerable number of transfers of regiments, which have retained their old colours on their shoulder-straps, and it is not always possible to identify troops by this mark.³

Most regiments have their number on the shoulder-straps, but it may be as well to observe that the only regiments whose shoulder-straps are without

¹ 3 active, 1 *dépôt*, 2 landwehr, 1 garrison, and $\frac{1}{2}$ in reserve.

² Additional particulars as to value and time of wear will be found in No. 503 of the "Revue Militaire de l'Étranger," May, 1880.

³ The colours of the shoulder-straps were as follows : Ist and IInd Corps, white ; IIIrd and IVth, bright red ; Vth and VIth, yellow ; VIIth and VIIIth, blue. The series of colours being recommenced with the IXth and Xth Corps. Corps with uneven numbers were further distinguished by a white piping to the facings.

either a number or the cipher of their honorary Colonel, are the four regiments of Prussian Foot Guards and the Guard Fusilier regiment.

The men of each battalion have a different coloured acorn on the sword-knot; this being white for 1st battalions, red for 2nd, and yellow for 3rd.¹ Men of the different companies are further distinguished by the colour of the crown and of the slide on the sword-knot, which are white for the 1st company, red for the 2nd, yellow for the 3rd, and blue for the 4th. The companies of a German regiment being numbered throughout the battalions from 1 to 12, these numbers are marked on the button of the shoulder-strap, so that it is always easy to recognize to what company a man belongs.

Depôt troops have the same dress and accoutrements as the corresponding field troops, and the only difference between the men of the landwehr and the line is that the former wear on the front of their helmets or forage caps the plain white cross, known as the landwehr cross.

The tunic worn by the German infantry is single-breasted, of dark-blue cloth, except in Bavaria, where light-blue is worn, with red collar, piping, and cuffs; the trousers are dark-blue with red piping (light-blue in Bavaria), and on the march are generally worn inside the long boots. The helmet (*pickelhaube*) is made of black leather with a peak both before and behind, decorated with an eagle in front and a cockade on the right side. This cockade is of the national colours of the State from which the regiment originates, and is black and white for Prussia, white and light-blue for Bavaria, black and red for Wurtemberg, and so on, each minor State or Principality having its own combination of colours. In Bavaria the metal spike on top of the helmet is replaced by a black woollen plume extending from the back to the top, from which this head-dress is called a *Raupen-helm*.

Riflemen wear dark-green tunics with red facings, and have grey trousers with red piping, the head-dress being a shako with a plume, instead of the helmet.

All German infantry wear a grey great-coat, which, when not in use, is carried in a roll extending diagonally across the body over the left shoulder.

Distinctive Marks of Rank.—It will be convenient before considering the arms of the German infantry soldier to mention the distinguishing marks of the various ranks. These are as follows:—

Non-commissioned Officers.—Lance-corporals wear a button embossed with an eagle on each side of the collar of the tunic. Non-commissioned officers of whatever grade have either silver or gold lace on the collar and cuffs, according as the buttons of the tunic are of white metal or brass, and generally wear a sword-knot of the national colours. Sergeants and sergeants-major have in addition a large eagle button on the collar of the tunic, sergeants-major being distinguished by their wearing an Officer's sword.

Portepée Fühnricks wear Officers' sword-knots and cockades, but are in all other respects dressed like sergeants-major, except that they have no eagle button on the collar.

Company Officers.—All infantry Officers wear a silver sash, and in the field Second Lieutenants may be known by plain silver shoulder-cords, with the number of their regiment on them in gold, while First Lieutenants and Captains wear the same with the addition of one gold star for the former, and two gold stars for the latter. For full dress, epaulettes are worn bearing stars similar to those just mentioned as indications of rank.

Field Officers.—Field Officers have twisted silver shoulder-cords with the number of the regiment, a Major having no star, a Lieutenant-Colonel one, and a Colonel two, exactly as in the junior ranks. The epaulettes which Field Officers wear in full dress differ from those of company Officers in having bullion fringes, but the distinctions of rank are similarly shown.

¹ Fourth battalions (formed on mobilization) have a blue acorn.

Medical Officers.—Medical Officers wear shoulder-cords carrying stars to indicate their relative rank, but their shoulder-cords have silk worked in, and rest on a blue or red velvet ground. They are further distinguished from combatant Officers by wearing on the shoulder-cord a peculiar badge—the rod of Æsculapius—and in action have always a white band with the Geneva cross on the upper part of the left arm. This band is worn by all members of the bearer companies, including the train soldiers employed as drivers, but the regimental stretcher-bearers previously referred to are distinguished by a red band, worn also on the left arm, but without a Geneva cross on it.

Paymasters.—Paymasters are distinguished by wearing on the shoulder-cords a coat of arms, and by their facings being generally dark-blue, with white buttons and helmet ornaments.

Volunteers.—One-year volunteers wear a twist of worsted of their national colours round the shoulder-straps, but are in other respects dressed as privates. Three-year volunteers have no distinguishing mark.

Generals.—General Officers wear blue tunics with red facings, the twisted shoulder-cords which they wear in the field being made of two strands of gold cord and one of silver. On these the rank badges are fixed in the usual way; a Major-General having no star, a Lieutenant-General one, and a General two. They wear silver epaulettes in full dress, with corresponding rank badges, the head-dress being a helmet with gold mountings and a black and white feather plume for parade, and their trousers having a broad red stripe.

Staff.—Officers of the General Staff have a dress similar to that of General Officers, but with crimson facings and double trouser-stripes, the lace and buttons being silver. Their helmet has silver mountings and a white horse-hair plume for parade, and all Staff Officers, with the exception of the Chief of the Staff of an Army Corps, are further distinguished by wearing the sash over the right shoulder.

Adjutants.—Adjutants wear their regimental uniform, but carry the sash over the right shoulder instead of round the waist.

Intendance.—Officers of the Intendance Department wear shoulder-cords of blue silk and silver lace twisted together; their tunics being blue with crimson facings, and their helmets ornamented with silver mountings.

Legal.—Auditors wear a uniform similar to that of Officers of the Intendance Department, but with red facings instead of crimson.

Chaplains.—Military chaplains wear the ordinary dress of their profession, with the addition of a band of violet silk with a white stripe on each side, worn on the upper part of the left arm.

Infantry Arms.—The German infantry are armed with the Mauser rifle, model 1871; a central-fire breech-loading arm of which the following are the principal data :—

| | |
|------------------------------------|------------------------|
| Length without bayonet | 4 ft. 5 in. |
| „ with bayonet | 5 ft. 11½ in. |
| Diameter of bore | 0·435 in. |
| Number of grooves | 4 |
| Twist | 1 turn in 50 calibres. |
| Weight without bayonet | 9 lbs. 9 oz. |
| „ with bayonet | 11 lbs. 3½ oz. |
| Charge of powder | 77 grains. |
| Weight of bullet | 382·4 grains. |
| Weight of cartridge complete | 648 grains. |

The Mauser rifle is sighted up to 1,600 metres, and with an elevation of 35° has an extreme range of about 3,000 metres.

The bayonet adopted for the German infantry is a sword-bayonet of which 10 per cent. are furnished with a saw back. Those non-commissioned officers

who do not carry rifles are armed with swords similar to those worn by Officers.

Weight carried.—The total weight carried by a German soldier, including his arms and 80 rounds of ammunition, is nearly 70 lbs., without counting the weight of the entrenching tool or the coffee-mill which may form an addition to his load.

Infantry Officers wear a small black leather knapsack when on active service, but their great-coats and baggage are conveyed in the company wagons.¹

Cavalry.—The following are the articles of clothing and equipment of a German cavalry soldier for service in the field :—

Clothing.—1 forage cap with cockade, 1 tunic, 1 linen jacket, 1 neckcloth, 1 pair trousers strapped with leather, 1 pair stable trousers, 2 pairs drawers, 1 cloak, 1 pair gloves, 1 pair boots, 1 pair short boots, 1 pair half-soles, 2 shirts.

Equipment.—1 helmet (or other head-dress), 1 cuirass (for cuirassiers only), 1 pair wallets, 1 sword-belt, 1 sabretache and girdle (for hussars only), 1 sword-knot, 1 pair spurs, 1 cross-belt and cartridge pouch, 1 carbine bucket and strap, sling, box of spare parts, grease-box, and 2 cartridge-boxes for men armed with carbines, and a pistol case and straps for men armed with pistols. Lancers have a lance, pennon, and straps, with 2 lance-buckets, and all cavalry carry canteens and bags for rice, salt, and coffee.

Miscellaneous Articles.—1 bag of bandages, 1 mark of identity, and a bag of cleaning materials. Small coffee-mills are also carried in the proportion of eight or nine per squadron.

Tools.—In each squadron 34 hatchets are carried on the troop horses, and besides these 6 hatchets and 8 spades are conveyed in each squadron wagon. Every squadron has moreover the set of light tools for the destruction of railways which has been already mentioned. These are secured in seven cases which are fitted for pack transport.

Cavalry Pioneers.—In the Bavarian and Saxon cavalry peculiar attention appears to have been devoted to the equipment of cavalry pioneers, four to six men per squadron being allotted to this duty and supplied with tools both for destruction and repair. These pioneers are armed only with sabre and pistol. In the rest of the German Army whatever steps may have been taken in this direction are kept secret.

Regimental Distinctions.—*Cuirassiers* : the jacket (*Koller*) is of white kersey fastened with hooks and eyes, with facings of a distinctive colour² the shoulder-straps being white, with an edging of the regimental colour, and bearing the number or distinguishing cipher of the regiment. Pantaloon of white kersey are worn with high boots reaching above the knee, but grey cloth trousers and linen stable trousers are also worn. The cuirass is of white metal, and consists of breast-plate and back-piece, and weighs about 16 lbs. All cuirassiers wear metal helmets, those of the Guard and the 6th Regiment being of brass, and the rest of white metal. In the Guards, the helmet is surmounted by an eagle for parade occasions, but in other regiments by a spike.

Arms.—Cuirassiers are armed with a straight sword (*Pallasch*) 37 inches long, and weighing 3 lbs. without the scabbard. Twenty-five men in each squadron are armed with Mauser carbines, and the rest carry six-chambered revolvers.

Squadron Distinctions.—In all German cavalry regiments the squadrons may be distinguished in the same way as the companies of an infantry

¹ A Captain is allowed 55 lbs., and a subaltern 46 lbs.

² Full particulars as to these colours are given in "Deutschland's Streitkräfte," and in Colonel Rivière's work.

battalion, viz., by the colour of the sword-knot, which is white for the 1st squadron, red for the 2nd, yellow for the 3rd, light-blue for the 4th, and green for the 5th.

Lancers.—The Prussian Lancers wear a short tunic (*Uhlanka*) of dark-blue cloth with collar and cuffs of the regimental colour, and for parade lappels of the same colour are worn. Dark-blue pantaloons, strapped with leather are worn, with boots reaching to the knee. The head-dress is the ordinary lancer hat (*Czapka*) of black leather with brass chain and white plume.

Arms.—Lancers are armed with the lance, a light curved sabre, and a breech-loading carbine which is similar in construction to the infantry rifle and takes the same ammunition. The lance is 10 feet long, and weighs $4\frac{1}{2}$ lbs. It has a four-edged tip 6 inches in length made of steel.

Dragoons.—In Germany dragoons wear a tunic of cornflower blue cloth, with collars and facings of the regimental colour, and a single row of buttons. Tight-fitting pantaloons of dark-blue are worn as in the lancers, the boots being of the same pattern. The infantry helmet is worn, with yellow or white mountings according to the colour of the buttons.

Arms.—Dragoons are armed with the same carbine as that adopted for the cavalry generally (model 1871), and with a cavalry sabre somewhat heavier than that used by the lancers.

Hussars.—The German hussars wear a short tunic (*Attila*) of various colours, red, black, brown, green, blue, &c., with five rows of worsted lace across the breast. The pantaloons are like those of the dragoons, with a narrow stripe of the same colour as the lace on the tunic. They are worn with a boot which reaches only to the middle of the calf of the leg. The hussars' head-dress is a busby with a plume, and a bag of the same colour as the tunic. In the Guard Regiment, and in the 3rd, 12th, and 15th Regiments, a blue pelisse lined with fur is worn either as an overcoat or hung over the left shoulder.

Arms.—The armament of hussars is exactly the same as that of dragoons.

Saxon and Bavarian Uniforms.—In the different contingents of which the German Army is composed, several differences have been retained, as for instance in the Saxon Lancers, which have light-blue tunics and pantaloons, and the Bavarian Lancers, whose uniform is a gray-green. The Bavarian heavy cavalry wear light-blue tunics with dark-blue pantaloons and leather helmets, while the Bavarian light cavalry wear a green tunic and green pantaloons, their head-dress being a helmet similar to that of the Bavarian infantry.

Weights.—The weight of a cuirassier or uhlan in complete marching order, with one day's oats and one ration of bread, may be taken as 22 stone, while that of a hussar or dragoon is about 18 stone.

Artillery.—*Field Artillery.*—The principal difference between gunners and infantry soldiers in the German Army is that the gunner's helmet is surmounted by a ball instead of a spike, and that the shoulder-straps are always red, with the number of the brigade marked on them in yellow. Drivers have pantaloons strapped with leather and high boots like dragoons, and horse artillery men are dressed almost in the same way, but have hair plumes to their helmets.

Arms.—Gunnery of field batteries are armed with the artillery fascine knife, but gunners of horse artillery batteries, non-commissioned officers, trumpeters, and drivers have a sabre similar to that used by the uhlans, and a revolver. Dismounted men of ammunition columns are armed with carbines, and sword bayonets.

Tools.—The entrenching tools carried with a battery, either of field or horse artillery, are 14 axes, 36 hatchets, 18 picks, and 29 spades.

Field Guns.—It has been mentioned already that the field battery and

horse artillery guns are known respectively as the 9-centimetre and 8-centimetre guns, and of these guns the following are the most important data :—

| | 8-cm. | 9-cm. |
|--------------------------------------|---------------|---------------|
| Calibre..... | 7·85 cm. | 8·8 cm. |
| Length..... | 82·68 inches. | 82·68 inches. |
| Weight | 7·67 cwt. | 8·86 cwt. |
| Number of grooves | 24 | 24 |
| Twist in calibres | 1 in 50 | 1 in 50. |
| Exterior diameter of gun at muzzle.. | 5·12 inches. | 5·51 inches. |
| " " " at breech.... | 8·46 " | 9·05 " |

The breech mechanism is similar in both guns, being the system known as Krupp's cylindro-prismatic wedge.

The following are some of the details as to the ammunition used with the German field guns :—

| | 8-cm. | 9-cm. |
|---|-----------------|-----------------|
| Charge | 2 lbs. 12 oz. | 3 lbs. 5 oz. |
| Weight of common shell (loaded).... | 11 " 3 " | 15 " 7 " |
| Bursting charge | 6 oz. 14 dr. | 9 oz. 14 dr. |
| Weight of shrapnel (loaded) | 12 lbs. 3 oz. | 17 lbs. 15 oz. |
| Bursting charge | 10½ dr. | 12½ dr. |
| Number of balls | 122 | 209 |
| Effective range, common shell, 25° elevation | 6,196 yards | 6,551 yards. |

The gun-carriages are made of steel, and the ammunition boxes of sheet iron. All the wheels are of similar construction, viz., of wood with metal naves, and of the same diameter (55·1 inches), so as to be interchangeable. The number of the regiment to which the battery belongs, the number of the battery, and the number of the gun are painted in white on each gun-carriage, and the other carriages of the battery are similarly marked. For example, the 5th gun of the 3rd Horse Artillery Battery of the 1st Regiment of Artillery of the Guard would be marked "1 G.A.R. 3.r. B. 5."

Pioneers.—There is practically no difference between the uniform of pioneers and that of infantry, except that the ornaments on the helmets of pioneers are always of white metal, and that they have only one pouch on the waist-belt instead of two.

Tools.—The tools carried by the men of a pioneer company are as follows : 18 hatchets, 44 pickaxes, 45 axes, and 88 large spades. In addition to these, however, 60 large spades, 30 pickaxes, 20 axes, 12 saws, and other tools are carried in the company tool wagon.

Telegraph detachments may be recognized by their wearing a T on the shoulder-strap, and railway troops by an E. The latter troops do not wear a helmet.

Arms.—Pioneers are armed with converted Chassepôt rifles, but have only 20 rounds of ammunition.

Train.—Train soldiers are equipped like infantry soldiers when attached to dismounted branches, and like cavalry when with mounted troops. Men of the train when permanently attached to other branches of the Service are dressed like the troops to which they are attached, but wear a forage cap with a peak, instead of a helmet.

The ordinary tunic of a train soldier is of dark-blue cloth with light-blue collar and cuffs, and when on duty with a train battalion he wears a shako and is armed with a converted Chassepôt rifle. Officers belonging to the train do not wear the shako, but have a helmet like that of infantry Officers.

XI.—OFFICERS.

The efficiency of the German Army is so closely connected with the system under which its Officers are appointed and trained, that even a brief sketch like the present would not be complete without some reference to this subject. The principle which is adopted, and which is most strictly followed, is that no post in the Army shall be held by anyone who is not *thoroughly* competent to perform its duties, every consideration being made to give way to what is really for the good of the Service. In accordance with this principle it is recognized that Officers should in all cases be of good social position, in order to maintain their authority over their men, and thus promotion from the ranks is practically unknown. As a general rule, a young man who wishes to become an Officer must first serve with the regiment as a *Portepée Fähnrich*, a position which he may attain in one or other of two ways. He may have become a cadet, and on completing the course of instruction laid down, be appointed to a regiment as a *Portepée Fähnrich*, or in a few cases of exceptional merit as a Lieutenant, or else he may, if between the ages of 17 and 23, enter the Army with the expressed intention of becoming an Officer in the regiment whose ranks he joins. A young man cannot, however, join a regiment under these conditions without the consent of its Colonel, and this consent is absolutely refused to any candidate whose character will not bear the severest scrutiny, and who does not appear in every respect suitable for admission as an Officer. A test examination must be passed, and the "*avantageur*," as he is styled, must also show that he has sufficient private means to enable him to live like a gentleman, besides proving his claim to gentle birth. When all these conditions are complied with, the *avantageur* joins the regiment as a private soldier, being required to perform all duties, other than those of a menial nature, exactly as other recruits, but as a rule being allowed a separate room in barracks, or one shared with another *avantageur*. He is, however, from the first accepted as an associate by the Officers of the regiment, and is allowed to dine at mess, where his behaviour is naturally a matter of careful scrutiny.

After some five months' service, having by this time thoroughly learnt his duties and been dismissed drill, he is given the rank of non-commissioned officer on the recommendation of his Captain, and after about ten months' service is sent to the War School¹ with the rank of *Fähnrich*, being there instructed in tactics, fortification, and other military subjects. At the end of his course he rejoins his regiment and serves as a *Fähnrich*, but now wearing an Officer's sword and doing Officer's duty, until a vacancy occurs among the Lieutenants. His name is then submitted at a meeting of all the Officers of the regiment, who have to give their votes individually for or against his admission as their comrade. If all are unanimously in his favour he is at once recommended for a commission, but if he has only a majority of the votes, those who are opposed to his admission are called on to state their objections in writing, and a summary of these opinions is laid before the Commander of the Army Corps, by whom the question is finally decided. If the majority are against the candidate, and consider him unfit to become an Officer, he is at once rejected, and can never hope to obtain a reversal of this decision.

When a young man has once become an Officer his promotion generally goes forward by seniority, always supposing that he has proved himself fit for the duties of a higher rank. His fitness in this respect is, however, not ascertained by examination as we understand that term, but by the manner in which he has executed a number of military problems submitted to him in the course of his service, as well as by the manner in which his ordinary duties

¹ There are in all nine of these schools, established at Potsdam, Metz, Anklam, Neisse, Engers, Glogau, Hanover, Cassel, and Munich.

are performed. As high military training is not a matter of recent introduction in the German Service, it follows that the superior Officers are thoroughly conversant with every detail of their subordinates' duties, and perfectly capable of judging of their fitness for promotion, so that if an Officer is considered unsuited for a rank higher than that which he holds, he will be remorselessly passed over, and no amount of interest or favouritism will enable him to reach a position in which he might, by his ignorance or inefficiency, cause or conduce to a military disaster.

Those Officers who have peculiar ability and ambition seek to belong to the General Staff, by which they obtain more rapid promotion than falls to the lot of the regimental Officer, and through which alone they can hope to reach the highest posts in the Army. Any subaltern Officer of more than three years' service may present himself for admission to the Krieg's Akademie, and from those who present themselves 100 are annually selected. This selection is made partly on the basis of the results of an examination which all must pass, but to a greater extent on the personal report of the candidate made by the Officers under whom he has been serving. After three years spent at the Krieg's Akademie the Officers are sent back to their regiments, there being no final examination at the end of the course of study, and are afterwards chosen for duty with the Headquarters Staff in accordance with the reports which have been received of their ability and industry during the time passed at the college. In the year and a half which these selected Officers spend at Headquarters they are under the eye of Field-Marshal von Moltke, and those of them who are recommended by him are transferred to the Staff Corps and promoted to the rank of Captain, by which step the Staff Officer usually gains about one year's seniority over the regimental Officer. After about two or two and a half years' duty on the Staff, the Captain is sent to command a company, squadron, or battery, according to his arm of the Service, for about two years, and if he continues to show a constant zeal and interest in his profession he is then promoted to the rank of Major, and thus gains a total advantage of from five to six years' seniority. In every rank the Staff Officer does duty both on the Staff and with a regiment of his original arm of the Service, but not among his old comrades whom he has superseded, and if at any time it appears that his physical powers are failing, or that he is less zealous or less devoted to his duties than he formerly was, his military career is practically at an end.

Officers who have not passed through the Krieg's Akademie are also selected on the recommendation of their Commanding Officers, and their merits are tested by certain military problems sent to them by Field-Marshal von Moltke. If these are dealt with satisfactorily, the Officers are attached to the Great General Staff and further tested in the same way as those who have successfully passed through the Krieg's Akademie, when, if their work meets with approval, they obtain the same reward, namely, admission to the Staff Corps.

Promotion in the German Army in peace-time is slow, especially in the lower ranks, the average time spent as a subaltern being 12 years, and as a Captain from 6 to 8, so that the advantages held out to those who prove themselves worthy of Staff employ are very substantial, but to reap the full benefit of these advantages the Officer must never relax his diligence, but must always prove himself the superior of the highly educated regimental Officers over whom he is placed in the intervals of his Staff service.

In considering this German system of advancement by merit not determined by the hard and fast rules of the percentage of marks gained at an examination, one cannot help being struck by the evident absence of any fear that the selection of individuals might be attributed to jobbery. The efficiency of the Army is so keenly felt by every German to be a matter of life and death to the

nation, that the idea that any possible consideration should interfere with securing the services of the very best man for each post seems never to enter the mind of any critic, whether civil or military.

XII.—MILITARY DISCIPLINE.

Habits of discipline are well understood by every German before he joins the Army, having been learnt by home teaching as well as by the training to which he is subjected in the Government schools throughout the country, and consequently the recruit adapts himself naturally to barrack life. But with such a high standard of intelligence and education as the average German recruit brings with him, it is more necessary to guard against his cavilling at the orders which he may receive, than to provide for direct disobedience of those orders; and this is secured by the personal influence of the Officers quite as much as by the infliction of punishment.

Officers, however, are armed with considerable powers; the punishments which they can award being as follows:—

For non-commissioned officers: reprimand, with various degrees of publicity; extra duty; confinement to barracks up to four weeks, or in lock-up to three weeks.

For lance-corporals and privates: extra duties, or attendance at roll call in specified dress; deprivation of control over pay for a limited time; obligation to return to barracks at an earlier hour than tattoo for the space of four weeks; arrest in barracks (open arrest) up to four weeks; arrest in lock-up (medium arrest) up to three weeks; arrest in cells (close arrest) up to fourteen days.

The extent to which Officers can award summary punishment varies with their rank. Thus, while the commander of a regiment can give the heaviest punishments above mentioned, the commander of a battalion can only give up to 14 days' arrest in barracks for non-commissioned officers and privates, up to 10 days' arrest in lock-up, and up to 7 days' in cells, for privates only. In the same way the company commander cannot give more than 8 days' arrest in barracks to non-commissioned officers and privates, and 5 days' arrest in lock-up, or 3 in cells, to the privates under his command.

Officers are liable to be punished either by reprimand, or by arrest in quarters up to 14 days, but arrest for this period can only be awarded by the General commanding the Army Corps. A Divisional commander can sentence an Officer to 10 days' arrest, and a regimental commander may give 6 days, but if a battalion commander finds it necessary to place an Officer in arrest he must report at once to the regimental commander, by whom the duration of the arrest is determined.

Where the offence is too serious to be dealt with summarily, the case is submitted either to a regimental or to a general court-martial, after having been first investigated by a court of inquiry. The regimental court-martial has the following composition: a Captain is President, the members being two First Lieutenants, two Second Lieutenants, two non-commissioned officers, and two privates; these latter being replaced by two non-commissioned officers where the prisoner is a non-commissioned officer. The other nature of court-martial is called a general or garrison court, and consists of five ranks of members, of whom the President is one, with a Deputy Judge Advocate or investigating Officer as assessor. The composition of the court varies according to the rank of the prisoner, as shown by the following table:—

| Rank of accused. | Field-M Marshals. | Generals of infantry. | Lieut.-Generals. | Major-Generals. | Colonels. | Lieut.-Colonels. | Majors. | Captains. | 1st Lieutenants. | 2nd Lieutenants. | Sergeants. | Non-commissioned officers. | Privates. |
|--------------------------------|-------------------|-----------------------|------------------|-----------------|-----------|--|---------|-----------|------------------|------------------|------------|----------------------------|-----------|
| Private | .. | .. | .. | .. | .. | .. | P | 2 | 2 | | | | 3 |
| Non-commissioned officer | .. | .. | .. | .. | .. | .. | P | 2 | 2 | 2 | | 3 | 3 |
| Lieutenant | .. | .. | .. | .. | .. | P | 2 | 2 | 2 | 2 | — | — | — |
| Captain | .. | .. | .. | .. | P | 2 | 2 | 2 | 2 | — | — | — | — |
| Major or Lieut.-Colonel | .. | .. | .. | P | 2 | 2 | 2 | 2 | — | — | — | — | — |
| Colonel | .. | .. | P | 2 | 3 | 2 | 2 | — | — | — | — | — | — |
| Major-General | .. | .. | 3 | 3 | 3 | } and a General of superior rank as President. | | | | | | | |
| Lieut.-General | .. | 3 | 3 | 3 | .. | | | | | | | | |
| Field-Marshal | 3 | 3 | 3 | .. | .. | | | | | | | | |

When the offence with which the prisoner is charged is grave, and entails capital punishment or imprisonment for life, there are three members of each rank in addition to the President.

The punishments to which a German soldier is liable are death, confinement (*i.e.*, imprisonment, detention in a fortress, or arrest), and, when the offence is of a dishonourable nature, dismissal from the Service with incapacity to serve again in the Army or the Navy. A sentence of arrest is given when the period of confinement does not exceed six weeks, but one of detention in a fortress or imprisonment may be for life. The maximum period of close arrest is not to exceed four weeks, during which time the prisoner is in solitary confinement in the dark with a hard board for a bed, and bread and water as food, except every third or fourth day, when he is given his usual bed and diet.

When on active service and means are not at hand for carrying out sentences of confinement, offenders are instead tied up to a post for a certain number of hours during the day, or left fastened all night in a similar manner.

Courts of Honour.—Differences between Officers are referred to tribunals known as courts of honour, whose duty it is also to guard the honour of the cloth by taking proceedings against any Officer whose conduct appears to be unworthy of the position he holds. These courts are of two kinds: one, for the trial of Captains and subalterns, formed of all the brother Officers of the accused under the presidency of the Colonel, and one for the trial of a Field Officer, composed exclusively of Field Officers of the Army Corps, under the presidency of a General specially detailed.

Councils of Honour.—From the members of each court of honour a sort of standing committee called a council of honour is annually elected. This council, which for a regiment consists of a Captain and First Lieutenant and Second Lieutenant, and for an Army Corps of a Colonel, a Lieutenant-Colonel, and a Major, has the duty of calling attention to the conduct of any Officer whom they consider to have acted in an unbecoming manner, and on being so ordered by the Commanding Officer, may make a preliminary inquiry into the circumstances of the case. When this inquiry is completed the council lay their report, together with the defence of the accused Officer, before the court of honour, and this court then gives its judgment. Its verdict may be to the

effect that it is incompetent to try the case, or that the investigation should be more fully gone into, or it may either acquit the accused or recommend him for punishment. The punishments which a court of honour is competent to recommend are that the accused Officer should be reprimanded, that he should be allowed to retire from the Service, or that he should be dismissed from the corps of Officers. The recommendation of the court having been put into the form of a judgment by the council of honour, is sent with the proceedings to the Emperor for his decision. It is to be observed that the members of a court of honour are not sworn, and have no power to administer an oath to a witness, but in adjudicating on a case they are placed on their honour, and the Officers who appear before them as witnesses give their evidence under the same conditions.

In concluding this short outline of some of the most salient features of the German Army, it may be as well to note that as yet, in spite of the adoption of a Colonial policy by Germany, no provision appears to have been made for the despatch abroad of such small expeditions as those which we have so frequently been obliged to send to our Colonies. It remains to be seen whether, when the emergency arises, Germany will be more successful than France has been in overcoming the difficulties of combining such expeditions with a system of universal military service, but if we consider this highly organized German Army as it stands, merely with reference to its employment in Europe, the question inevitably presents itself, "Against whom will this powerful engine next be employed?"

That it will be against either France or Russia, or the forces of both these Powers combined, seems more than likely, but though in any case a far more severe struggle than that of 1870-71 may be anticipated, those who are best acquainted with the German Army and the German people have little doubt as to the result; and to us Englishmen it may well be a source of satisfaction that this paramount position as a military Power should be occupied by the nation to whom we are most closely allied by ties of policy, as well as by the bonds of race and religion.

REVIEWS.

Our South African Empire. By W. Greswell. London: Chapman and Hall, 1885. 2 vols. Pp. 640. Size $8'' \times 5\frac{1}{2}'' \times 2\frac{3}{4}''$. Weight 3 lbs. Price 21s.

Mr. Greswell gives us a history of South Africa from what he considers its commencement in 1652, when Van Riebeck landed in Table Bay, down to the present time. As he truly says, our South African Empire has grown up in spite of the protests of the mother country. It has never been clearly and definitely laid down whether an independent Dutch State or States should be allowed to exist alongside of our own Colonies or not. Consequently we hear of independence being given and then taken away. The Republics themselves have been at a loss to know what the real intentions of Englishmen have been in South Africa, their affairs being first at the mercy of a progressive and then of a retrogressive Cabinet in England. Mr. Greswell feels convinced that the country has a magnificent future before it, and this feeling probably colours his views, but at all events the effort to promote the interests of South Africa is a laudable one. Mr. Greswell says: "South Africa sighs for peace, and until peace spreads her ample wings over the land there can be no progress or civilization. The native is the subject over whom the wrangle of debate and the clash of battle is heard." The real difficulty seems to us to be that the native of South Africa, unlike the native in Australia, New Zealand, or America, does not appear to have the slightest intention of "dying out," and his persistent refusal to offer this simple solution of the real African question constitutes the difficulty, a difficulty still further increased as he is not to be made to work for the white man. Mr. Greswell's work is, however, a timely contribution to the consideration of the subject.

Turenne. By H. M. Hozier. London: Chapman and Hall, 1885. Pp. 198. Size $7\frac{3}{4}'' \times 5\frac{1}{4}'' \times \frac{1}{2}''$. Weight under 12 ozs. Price 4s.

The endeavour of Colonel Hozier is to give a connected story of the steady advance in life of this great commander, and to trace the various changes which he conducted in the science of war from the time that he was first made a Marshal until he fell mortally wounded. Not confining his efforts to mere biography, Colonel Hozier deals with the questions why early in the seventeenth century cavalry was a predominant force in European armies; why sieges were as a rule the principal operations of war; and with other important military questions. By the issue of this handy series of military biographies, Messrs. Chapman and Hall are supplying a real *hiatus* in the libraries of Officers.

Suakin. 1885. By Major E. Gambier Parry. Second Edition. London: Kegan Paul, 1886. Pp. 271. Size $6\frac{3}{4}'' \times 4\frac{1}{2}'' \times \frac{3}{4}''$. Weight 12 ozs. Price 5s. New edition, with author's name, 2s. 6d.

A pleasantly written and chatty sketch of the author's personal experiences.

From Korti to Khartoum. By Colonel Sir C. W. Wilson. London: Blackwood, 1885. Pp. 313. Size $7\frac{1}{2}'' \times 5\frac{1}{2}'' \times 1\frac{1}{4}''$. Weight 1 lb. 5 ozs. Price 5s.

Well written and invaluable as a contribution to the "History of the Nile Expedition," inasmuch as the author occupied a prominent position in the events he narrates. The campaign with which Sir Charles deals is too recent for us to offer any criticism on the work before us.

The Coming Struggle for India. By Arminius Vambéry. London: Cassell, 1883. Pp. 208. Size $8'' \times 5\frac{1}{2}'' \times 1''$. Weight 1 lb. 2 ozs. Price 5s.

The contributions by this well-known writer to the discussion of the important

question which he deals with are always valuable, and hardly require the excuse which he puts forward in the concluding chapter for his pertinacity in continuing his progress along the path of political writing.

Cromwell et Mazarin. Deux Campagnes de Turenne. Par Jules Bourelly. Paris : Perrin, 1886. Pp. 323. Size $7\frac{1}{2}'' \times 4\frac{3}{4}'' \times 1\frac{1}{4}''$. Weight 1 lb. 3 ozs. Price 4s.

This work, for the composition of which the author has made use of a number of letters hitherto unedited of Mazarin and Turenne, is a valuable contribution to the study of the military history of this period.

History of Burma. By Lieutenant-General Sir Arthur Phayre. London : Trübner, 1883. Pp. 304. Size $8\frac{1}{2}'' \times 6'' \times 1\frac{1}{4}''$. Weight 1 lb. 12 ozs. Price 14s.

This book is one of Trübner's Oriental Series, and will be found of great interest to those who, now that Burma is part of the Empire, have their attention turned in this direction.

Martial Law and the Custom of War. By Lieutenant-Colonel Tovey, R.E. London : Chapman and Hall, 1886. Pp. 168. Size $7\frac{3}{4}'' \times 5'' \times 1\frac{1}{4}''$. Weight $1\frac{1}{4}$ lbs. Price 4s.

Even the dry subject of Martial Law can apparently be made interesting, and Officers would in view of the state of things at home do well to turn to this book and see how military men are situated in the event of social disturbances.

The Parliamentary Generals of the Great Civil War. By Major Walford, R.A. London : Chapman and Hall, 1886. Pp. 268. Size $7\frac{3}{4}'' \times 5\frac{3}{4}'' \times 1''$. Weight 14 ozs. Price 4s.

In a few pages the author brings before us the principal events of the history of this war. We own, however, a feeling of regret that Major Walford, so thoroughly able as he is to unravel the entangled threads of campaigns, has been restricted in the space at his disposal. The account of the armament and the tactics of this period given in the introduction are most interesting, and we should have been glad if the strategy of the war had been explained at greater length.

Cavalry Instructions. Course of Lectures. By Captain Baden-Powell, Adjutant 13th Hussars. London : Harrison, 1885. Pp. 213. Size $4\frac{1}{2}'' \times 5\frac{1}{2}'' \times 1\frac{1}{2}''$. Weight 5 ozs. Price 3s. 5d.

This little book shows in the fullest detail one method of carrying into practice the one month's Squadron Instruction prescribed by G. O. 30, 1884. No one method can be rigidly applied everywhere ; each place necessitates modifications ; and the more the various methods adopted in different regiments or in different garrisons brought before the military public, the greater chance there is for a squadron leader to evolve from them the method most suited to his own requirements. A second edition has just been published.

Remarks and Suggestions on our Military System. By Captain Purdon, North Staffordshire Regiment. Chatham : Gale and Polden. Pp. 63. Size $5'' \times 7\frac{1}{4}'' \times \frac{1}{4}''$. Price 2s., post free.

Captain Purdon offers some suggestions with a view to promoting the smooth working of general efficiency of our military system, and to rendering its organization more handy in time of need.

Précis de la Campagne de 1805 en Allemagne et en Italie. Brussels : Marquardt, 1886. Pp. 267. Size $5'' \times 6\frac{3}{4}'' \times 1''$. Weight under 1 lb. Price 4s. 6d.

This volume is the first of a projected series of works on military history, entitled "Bibliothèque Internationale d'Histoire Militaire," which is to be completed in twenty-five volumes, the last of which will treat of the operations of 1828-29 and 1877-78 between Russia and Turkey. The whole series covers European wars from 1630 to the present time.

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NAVAL PRIZE ESSAY.

THE CHANGES IN THE CONDITIONS OF NAVAL WARFARE, OWING TO THE INTRODUCTION OF THE RAM, THE TORPEDO, AND THE SUBMARINE MINE, HAVING REGARD CHIEFLY TO THE FOLLOWING POINTS IN OUR OWN AND FOREIGN NAVIES, VIZ.:—TRAINING OF PERSONNEL; CONSTRUCTION AND PROTECTION OF MATÉRIEL; AND ATTACK AND DEFENCE OF SHIPS AND HARBOURS.

By Lieutenant FREDERICK C. D. STURDEE, R.N.

“Tempora mutantur.”

WE have divided the essay into four chapters, and will consider each subject separately, thus:—

- Chapter I. Training of Personnel.
,, II. Construction and Protection of Matériel.
,, III. Attack and Defence of Ships.
,, IV. „ „ Harbours.

We will first proceed to discuss the training of personnel, as it must always be the first thing to be considered, as ships without well-trained Officers and men to man them, would be useless.

CHAPTER I.—*Training of Personnel.*

This may be divided into two parts, (1) the training of the Officers; and (2) the training of the men; each part may be again divided into different parts, according to the different branches to which the Officers and men belong.

We will first consider the training of the executive Officers, and before stating any ideas that we may hold, will look about for some fair criticism on the education of naval Officers, of which no doubt there are many, but we will refer to one in particular, that is one by Professor Soley, who was ordered by the American Government to make a report on the different systems of European education, and he thus

sums up our system:—"Although it has made undoubted progress, it has been after all a long series of changes, experiments, renewed experiments, and expedients of all kinds, from which even now it cannot be said that a harmonious or satisfactory system has been evolved.

"In fact it is rather a combination of makeshifts, resulting from a series of tentative and spasmodic efforts in almost every form which naval education is capable of taking.

"The Naval Administration never seems to have looked at the subject as a whole, from the beginning in the entering examination of cadets to the final stage at the promotion of Sub-Lieutenants, and to have worked out a systematic plan which should have both cohesion and consistency."

He proceeds to criticize the different parts of the education, and his criticism is by no means favourable, as the above opinion shows.

There seems to be another awakening up to the fact that our education is not quite what the nineteenth century demands, as is shown by a committee being appointed to consider naval education, from which great results ought to be expected, but as we have not yet heard the result of their deliberations, we are at liberty to state whatever poor opinions we may hold on this important matter.

We will begin with a brief summary of the present system.

A cadet joins the Service between the ages of 12 and 13½—which many Officers consider much too young to begin the technical part of his education solely—but a compromise has been made, and he still is taught a certain number of school as well as technical subjects, but several important school subjects have to be dropped for want of time, such as Classics, English Grammar, and Literature. But now a little time has been devoted to these subjects, which is necessarily very limited on account of the many other subjects, and helps to make the course in the "Britannia" more of a cram, so much so, that it may safely be assumed that very few cadets get a good groundwork; the remainder having only a smattering of knowledge, as is shown by the comparatively few first class certificates obtained on leaving the "Britannia."

When the cadets go to sea, most of them are sent to ships with a Naval Instructor, who tries to impart more knowledge to them, but there are so many obstacles to be overcome, that very little is ever learnt by the majority of midshipmen at sea; besides a seagoing ship does not seem a suitable place to teach midshipmen subjects that could be learnt at school, thus wasting valuable time which should be given to strictly professional subjects.

The result is that when acting Sub-Lieutenants join Greenwich, they rarely know as much of the "Britannia" subjects as when they left that ship, while some may have been fortunate enough to have picked up a smattering of mechanics, and learnt a little more practical navigation.

The Greenwich course lasts for six months, when the subjects are again gone over, and all are a little more crammed for the final examination, a few hard-working and lucky Sub-Lieutenants obtaining first

class certificates; but as no encouragement is given to those that are not able to obtain firsts, a fairly large proportion only obtain thirds, and these must leave without having derived much benefit from the six months' instruction.

The torpedo course comes next, which is much too short, being only a month's course, so that there is very little time to obtain more than a general idea of torpedo work; this is particularly a course which everyone might and should do well in if they only work, but if they have been unfortunate at Greenwich it is not worth their while to work. This is the same with all the other courses, and might, we think, be obviated, if those who miss obtaining five first class certificates got some advantage, instead of, as at present, a Sub-Lieutenant with five thirds probably getting promoted as soon as one with three firsts and two seconds.

The gunnery course is a very good one, as it is quite long enough, and every Sub-Lieutenant who works, should go to sea with a good knowledge of gunnery. Pilotage comes next, which, we believe, has been recently altered, but still a great deal of time seems to be thrown away in learning tables by heart; and it might be made more practical.

The naval Officer's education is now complete, unless he wishes to take up a *spécialité*. If he studies for a Gunnery Lieutenant, which is the most advanced mathematical course, a great part of the time is taken up in re-learning elementary mathematics, and as the whole course is only nine months, not as much time as might be, is given up to higher mathematics. Our courses do not compare very favourably with foreign Officers' courses, as acting Sub-Lieutenants in Germany and *élèves* or naval cadets in France have the same standard to pass as our Gunnery Lieutenants, conclusively showing that our education is rather behindhand; this Professor Soley owned, although he said the courses in the "Excellent" and the "Vernon" left nothing more to be desired.

Having briefly examined our present system of education, we proceed to point out what seem to be some of the remedies.

The first fundamental change that is required is to increase the age of entry, so that a thorough groundwork of an education should be learnt at school, and the more advanced school subjects and technical education only learnt in the Service. The age of entry, we think, might advantageously be raised from between 12 and 13½ to between 14 and 15, as the old idea of cadets joining early was to accustom them while they are boys to the hardships of a nautical life, and also that it used to be considered that no one could become a thorough seaman unless the training was begun at a very early age; whereas now the hardships of a nautical life are very much minimized, and a naval Officer besides being a seaman should have a very good general education, besides a scientific education in order to take charge of the complicated ships of the present day.

It seems the most natural plan that the general education should be learnt first, and then the technical education, this plan being adopted in all other professions except the Navy.

The examination on entry should be fairly difficult, so as to get the best boys, the subjects for examination should be as near as possible those taught at the public schools, so as to prevent the system of cramming which is very prevalent now.

We have drawn up a list of subjects that the boys should have to take up, so as to give a rough idea of the examination they should be expected to pass.

The following is the list of subjects:—1. Arithmetic; 2. Algebra including Quadratic Equations and the different Progressions; 3. Euclid, 1st, 2nd, and 3rd Books; 4. Dictation; 5. English Grammar; 6. French; 7. Latin, I, II, and III Books of Cæsar, and 1st Book of Virgil; 8. Geography; 9. English History.

Optional Subjects:—At least three of these subjects might be compulsory:—Greek, German, Drawing, Physics, Trigonometry, Mechanics.

The candidates that pass would go to the “Britannia,” but instead of being there only two years should be three years on board, then their age on passing out of the “Britannia” would be between 17 and 18. For the first year Latin and English Literature might be taught; but with the numerous subjects that should be learnt it is questionable whether there would be time for them, and all the time should be devoted to technical and professional subjects, or those subjects which are necessary to learn before being able to learn some of the technical subjects.

During the course the following subjects should be taught:—1. Algebra; 2. Euclid, as far as Book XII; 3. Trigonometry, Plane, Spherical, and Theoretical; 4. Practical and Theoretical Navigation; 5. French; 6. Kinetics and Kinematics; 7. Hydrostatics; 8. Physics; 9. Surveying; 10. Inorganic Chemistry should be taught during the 2nd and 3rd years; 11. Conic Sections should be taught during the 3rd year; 12. Shipbuilding and Naval Architecture should be taught during the 3rd year; 13. Steam should be taught during the 2nd and 3rd years; 14. Naval Tactics should be taught during the 3rd year; 15. Differential and Integral Calculus should be taught to a special few who are likely to understand it, and would be able to apply the knowledge, some encouragement should be given them to take it up, either by extra marks being given for it, or a prize for the one that passes the best examination in these subjects; 16. Two afternoons a week should be devoted to Seamanship; and cadets during their 2nd and 3rd years should go for a month’s cruise during the summer in a training brig; this would be a relaxation from their indoor studies, and would be the best way of teaching them practical seamanship; they should work one of the masts, keep midshipmen of the watch, and do boat duty when in harbour, so as to teach them a little of their work as Officers. Then after coming back from their cruise, they could go on their summer’s leave.

To carry out this proposed system properly, an increased number of instructors would be required, as now the proportion of two instructors to every term of from 40 to 50 cadets is hardly sufficient, as one instructor is hardly enough to teach from 20 to 25

cadets, but if there were three instructors to every term, the classes would be a very fair size, and there would be so much more instruction given; this would increase the number of instructors from 8 to 18, as there would be six terms on board, instead of four as at present, on account of the increased time in the "Britannia," but as we are recommending naval instructors being done away with at sea, it would be more economical than at present, where there are upwards of 35 instructors teaching midshipmen at sea; some of them are chaplains as well, so that these would still have an occupation in the Service. A few of these instructors should be particularly good men, so as to be able to lecture on mathematics, and particularly those that take the third year cadets.

Two natural science instructors would be required instead of one as at present. Great care should be taken to have good French masters, as the comparative ignorance of a great number of naval Officers in the French language must be due to the bad instruction they have received, and not sufficient importance being given to foreign languages.

An instructor would be required for steam, another for ship-building, another for chemistry, and one naval executive Officer to lecture on naval tactics. No instruction whatever is given at present in this important subject, naval Officers being expected to pick it up, which without some groundwork to commence with, it is very difficult to know where to begin. At present our ships are fitted with rams, and no one is taught how to use them, yet we are taught how to use guns and torpedoes.

The French fully recognize the advantage gained by having a large number of instructors, as they have 12 Professors, 8 Lieutenants, and a Chief Engineer, making 21 in all for an average number of 90 cadets only.

On passing out of the "Britannia" sea-time should be given in the same way as at present, so that cadets obtaining a year's sea-time will only have to serve two years more as midshipmen. During this time they would have to learn the practical part of their profession, viz., seamanship, steam, gunnery, and torpedo exercise; of course by this arrangement, two years instead of four years would only be served as midshipmen, but this is not so bad as it appears at first sight, as no time would be wasted at sea at school work, and the midshipmen would be always available for practical work; and if every midshipman is sent to a cruizer instead of an ironclad as at present, they would certainly get as much experience in two years as if they had been four years in an ironclad. A regular system might be devised to teach them their professional subjects. Every midshipman except the boat midshipman should keep watch, and at sea the senior midshipman of the watch should be allowed to work the ship under the Officer of the watch, the Officer of the watch in the day time being allowed to leave him in charge of the ship, the next senior midshipman of the watch doing duty as mate of the forecastle.

One day a week might be devoted to gunnery, one forenoon to torpedo work, one afternoon to steam, one forenoon to practical navigation, and two days to seamanship.

This would leave Thursday afternoon and the whole of Saturday spare, as at present.

Any instruction should be left off for a general evolution.

Midshipmen of boats not to be excused boat duty for instruction, so all midshipmen ought to take a turn as boat midshipmen. Midshipmen of the watch, if there is any particular work going on, not to be excused watch for instruction.

Midshipmen would be told off to tops and quarters as at present.

Out of the two days' seamanship, boat sailing, fleet tactics with steam and sailing boats, exercise aloft and splicing, &c., should be taught.

The afternoon devoted to steam should be employed with practical engineering, so as to enable every midshipman to know how to work an engine in case of an emergency, the theoretical part being taught in the "Britannia," and if possible when under steam one midshipman of the watch might be allowed to go down in the engine-room so as to learn further how to take charge of the engine-room and stokehold.

After being two years midshipmen, or between two and three years after leaving the "Britannia," according to the time obtained on leaving that ship, midshipmen would be eligible to pass the seamanship examination (they would be between 19 and 21 years of age).

This examination might be passed provisionally at sea, midshipmen should be able to work the ship (if they have been allowed to keep watch) and might be examined by doing it practically, besides the ordinary questions as at present.

If they pass, they should be sent home, and on arrival pass their seamanship examination finally before a specially appointed Board at Portsmouth; an arrangement like this would probably make more uniformity in the value of the different classes than is supposed to be the case at present by many Officers.

After passing in seamanship, they should not be sent to Greenwich, as the compulsory school subjects have been finished in the "Britannia," but instead, should go straight to the College at Portsmouth, where they would live as at present during the time they are going through the different courses.

1st. A month's course in steam; this would be a valuable addition to the present instruction, and the marks obtained in the examination at the end of the course might be added to one of the other subjects (in order to save an extra classification), say torpedo.

2nd. A three months' torpedo course, instead of a month, as at present, this would be a great gain to the Service, as it is always found on board the "Vernon" that Sub-Lieutenants pick up torpedo work quicker than any other class of Officers or men, and with the lengthened course a good knowledge of torpedo work would be obtained. A week at least of this time might be devoted to the management of the various kinds of torpedo-boats, so that in a few years we should have a large number of Officers that would know something about the management of these boats, instead of as at present when many Officers are appointed to torpedo-boats, they have

to pick up this knowledge after their appointments, as they may never have been away in one of these boats before.

3rd. A three months' gunnery course, the same as at present.

4th. A three months' pilotage course, which should be made as practical as possible, to enable any Sub-Lieutenant on leaving to have a good idea of how to navigate a ship from one port to another.

Captain Fitzgerald made a very valuable suggestion, that all Sub-Lieutenants should be taught the art of ramming in specially protected gunboats, so as to prevent them being seriously damaged if they are rammed; this instruction might be included in the pilotage course, a fortnight being devoted to it, as we think he recommended. The whole of this instruction with leave would only take one year, instead of eighteen months as at present.

Classes of certificates should be given for seamanship, torpedo exercise (including steam), gunnery, and pilotage, and a system of promotion devised according to the classes obtained; in fact as a rule all Sub-Lieutenants might be promoted on a certain fixed system according to how they pass, except a few special promotions for war service, gallantry, &c.

At present there is such an enormous difference between a Sub-Lieutenant that obtains five firsts, and another that obtains three firsts and two seconds, that many do not work as hard as they might. This we mentioned before.

No Sub-Lieutenant should be more than four years in that rank, except perhaps for some good reason.

The following is intended to give an idea of a scale of promotion according to the classes of certificates obtained.

Thus if a Sub-Lieutenant obtains—

| | | | | | |
|------------------------|--|---|---|----|--------|
| 1 1 1 1 | he should only remain a Sub-Lieutenant for 6 months. | | | | |
| or 1 1 1 2 | " | " | " | 18 | " |
| " 1 1 2 2 or 1 1 1 3 | " | " | " | 2 | years. |
| " 1 2 2 2 " 1 1 2 3 | " | " | " | 2½ | " |
| " 2 2 2 2 " 1 2 2 3 | " | " | " | 3 | " |
| " 2 2 2 3 | " | " | " | 3½ | " |
| " or any lower classes | " | " | " | 4 | " |

The classes in either subjects being considered all the same.

Sub-Lieutenants after being fully qualified, should be sent to any ships as at present, until promoted. When promoted it would be a great gain to the Service if half pay could be entirely abolished, except as a punishment or at an Officer's special request; this even if it could not be done in the senior ranks might be arranged for Lieutenants at a small extra cost to the country, but if the Officers that were not actually in seagoing ships were obliged to go through courses, the country would be amply repaid by having a better trained body of Officers; every one recognizes half pay to be one of the worst things for the Service.

Now would be the time when the good groundwork of an education learnt at school and in the "Britannia" would tell, as when Lieutenants went through a course at Greenwich very little time need be given to elementary mathematics, and then more advanced

mathematics could be learnt by those that wished to take them up. No one that has no taste for mathematics should be obliged to learn more than a certain amount, as it does them very little good; but those Lieutenants that do not wish to take up advanced mathematics might be allowed to choose what subjects they would like, professional subjects being compulsory, such as naval tactics and strategy, shipbuilding, steam, nautical surveying, international law, besides two or three non-professional subjects should be made compulsory which could be chosen out of a list of these subjects.

Besides the Greenwich course, every Officer should be obliged to go through a gunnery and torpedo course every three years, or whenever it is convenient.

Another course of practical engineering and shipbuilding might be given at Portsmouth. Opportunities should be given to Officers to go abroad and learn European languages, and to prevent them being put to any great expense, lodging allowance and travelling expenses might be refunded to them if they pass an examination in a certain time: this would make sure that they had not wasted their opportunities.

Lieutenants should be in every way encouraged to take up specialities, so that we should always have a certain number of Officers qualified for the different appointments that they may be expected to fill.

Thus certain Officers should be specially trained in gunnery, torpedo work, pilotage, steam, nautical surveying, naval construction, higher mathematics, and applied mathematics. Lieutenants should be expected to know as much as possible about foreign navies; and opportunities should be held out to them to find out more than at present.

We now come to consider the recruiting for the two specialities, gunnery and torpedo work.

The course should be kept the same length as at present, except for the Lieutenants who obtain first class certificates, who, after finishing their training and being fully qualified as either Gunnery or Torpedo Lieutenants, should go back to Greenwich for another nine months, so as to go through an extra course of higher mathematics and applied mathematics, particularly as relating to their particular work. By this means we should have a body of Officers able to superintend in the manufacture of guns, for which, if the Navy is ever to have charge of the construction of its own guns, we shall want some Officers more highly trained than at present. The torpedo Officers would be better able to teach more advanced electricity, &c., to the Officers' classes, besides being better able to superintend in the manufacture of Whitehead torpedoes, and probably more capable of bringing out improvements in torpedoes, &c.

On account of the higher standard reached in the "Britannia," the Greenwich course for the qualifying Lieutenants could be made more advanced than it is at present, and all the qualifying Lieutenants should take up higher mathematics, including differential and integral calculus, and an elementary knowledge of applied mathematics,

besides a more intimate knowledge of the subjects at present taken up.

Torpedo Lieutenants should have a more advanced course of electricity than at present. The course in the "Excellent" and "Vernon" might be kept the same as at present.

We next come to the training of the other branches of the Service.

The only other branch that the introduction of the ram and torpedo has in any way affected, as regards their training, is the engineer's branch. Their branch being comparatively a modern creation, has not all the old associations to shake off as the executive branch, and is educated according to the nineteenth century idea; this means that they have a good mathematical and scientific education, and we believe it leaves nothing much more to be wished for, as since the introduction of the Whitehead torpedo and the electric light, all Engineers and Chief Engineers are taught these subjects very thoroughly.

The Officers of the Royal Naval Reserve are our next consideration.

The only education we can be expected to give them is the practical instruction of how to use guns and torpedoes, and to be able to perform an executive Officer's duty on board a man-of-war. Seaman-ship has not to be taught them, as they are all seamen to begin with. We believe they have a very fair course of gunnery as regards the length of the course, but the guns they are taught to drill with are very often very obsolete.

At present they are not taught anything about the duties they would be expected to fulfil on board a man-of-war, although a few were attached to the Evolutionary Fleet; and it would be a great improvement if every year a certain number could be appointed to the Reserve Squadron during their summer cruise, where they could actually learn about a man-of-war; by this means on the declaration of war we should be able to fall back on a number of well-trained Reserve Officers to fill up some of the appointments in our large ships, which is very important, particularly when our number of Lieutenants on the Active List is so very limited.

We do not believe that they are taught anything about torpedo work; but it depends very much what they are intended to do, whether it is much good teaching them anything about torpedoes; as if they are only intended to officer armed cruisers, it probably would only be superfluous knowledge, unless there was spare time during their training.

Training of Seamen.

Before the introduction of steam, our blue-jackets were only expected to be thorough seamen, have a smattering about truck gun drill, and be able to use a cutlass; but at the present time our men, besides being seamen, must be gunners and torpedoists, and the difficulties of becoming a seaman have increased enormously on account of the introduction of steam, and the time spent in learning the other two subjects, besides the ships being longer in harbour.

The great question to be solved is, how first to make our men seamen, and then how best to train them in gunnery and torpedoes.

Boys on joining the Service go first to the stationary training ships, which we believe answer very well; but of course very little practical seamanship is actually learnt in them. The brigs are in commission all the summer months from the 1st April to the 1st November, so all boys that have served their time in the stationary ships are sent to the brigs during those months; but as no brig is cruising for the other five months, a great number of boys never pass through the brigs at all, thus losing the most valuable part of their course. This might be remedied by increasing the number of brigs and arranging that all the boys that are likely to be drafted during these months should go to the brigs during the summer months.

Then it is important that more care should be taken where boys are sent after leaving the training ships, as now they are sent to harbour ships, ironclads, and cruisers indiscriminately.

The boys that are sent to harbour ships are only supposed to be six months on board of those ships, but they are very often nine months or a year instead. Imagine the small knowledge of seamanship they have when they go to sea, as the little they learnt when on board the harbour training ship is soon forgotten. We would propose, as a remedy, that there should be no boys' ratings in harbour ships, but ordinary or even A.B. seamen's ratings substituted instead; and that as many boys as possible be sent to seagoing cruisers, and as few as possible to ironclads, and none at all to mastless ironclads; neither should ordinary seamen be sent to harbour ships or mastless ironclads, unless they have served some time in a cruiser.

When there is a detached squadron—which for the good of the Service should always be kept in commission—boys and ordinary seamen should form a large part of the ship's company, having enough able seamen to get them into shape, and also in case of an emergency.

This is the principle which is adopted in the merchant service with the Officers, that every Officer is first taught to be a seaman, and then is eligible for a steam ship, and it is so far recognized that no large steam ship company take any Officers without they have served some time in a sailing ship; we believe this, that if it were more fully adopted into our Service for both Officers and men, great advantages would accrue from it.

We will now consider the training for the new rate of S.G.T.

The gunnery course lasts for four and a half months and the torpedo course for three months; at the end of each course there is an examination, and men get classes given them accordingly, so that they go to sea as S.G.T. first, second, or third class, or if they fail to pass, go back to the ordinary Service, without they bear a good character, and then they can become trained men.

By this means we get a large supply of men who are trained in the three branches, viz., seamanship, gunnery, and torpedo work; but it remains an open question whether we get such good men as if they

were only trained in one of these subjects besides seamanship, as to become a seaman gunner requires a different training to becoming a torpedo man, and it is generally found that men from the gunnery ships can learn by heart very well; but as a rule they cannot reason very much. Now torpedo work wants a good deal of intelligence, and parrot work is not much required. At all events we get a large number of the best men in the Service trained very fairly well in these subjects; but there seems to be an improvement which might be made to the present system—that is, that men who pass very well in either subject might be allowed to go through an extra course in that subject, for the reason stated above; many men pass much better in gunnery than in torpedo work and *vice versâ*, and at present we do not seem to take quite enough advantage of their extra qualifications. A certain limited number are recommended to qualify for gunnery or torpedo instructors and leading torpedo men; but in a ship, if we could get some more trustworthy men as gunners or torpedo men to hold some of the important positions, it would be a great thing. Now of course some of the S.G.T.'s are very well up, but with this system in a ship, we should have the instructors, &c., the S.G.T.'s who have been through an extra course (which should be marked on their certificates), and the ordinary S.G.T., so that we should have a large number of fairly trained men, the extra course men for captains of guns and torpedo carriages, &c., and the instructors, which would be a very good complement of trained men. All men passing for trained men at sea should be obliged to go through a short torpedo course; this would be a great help to them when they came home and wanted to qualify for S.G.T.

Now that torpedo-boats are becoming more numerous, a certain number of good petty officers who are S.G.T.'s, should be trained to steer and manage these boats, and if they prove themselves proficient should receive extra pay, and be given a special rating as coxswain of a torpedo-boat. This has been several times recommended, and is nearly a necessity, as the steering of a torpedo-boat is by no means such an easy thing as it appears at first sight, and men want practice in them before they can steer them at all well.

The next branch of the Service we have to consider is the engineering branch, the men of which branch are very fairly trained, as far as the engines of our large ships, &c., are concerned, but are not well enough trained in the working of torpedo-boats; at the commencement of a war this would prove a great difficulty. At present they rather avoid the boats, as the work is not so very pleasant; but if an inducement in the way of pay were given, we should get many of the best artificers and stokers to volunteer for the work, and these boats certainly require the best men to get the speed they should realize out of them.

There is another point: stokers should be trained to use a rifle, as since the introduction of steam, the gradual increase in the number of stokers and artificers in our ships, and in consequence of the masts being abolished, the decrease in the number of seamen in our ships, it becomes a matter for serious consideration, whether for the defence

of our ships against torpedo-boat attacks, stokers should not be taught how to handle, load, and fire a rifle, as now only forty to fifty per cent. of a ship's company can use the rifle, whereas in the French Navy only five per cent. *cannot* use a rifle. Why should not we copy their good example?

We do not mind so much about stokers knowing how to drill with the rifle, as that is superfluous; but all we want of him to know is to aim and be able to hit a boat, say at 800 yards or less. Now as a rule when a ship would be attacked by torpedo-boats, she would be at anchor, when all the stokers would be more or less available, and if it happened at sea, the greater part would be also available.

The training required would be comparatively little, viz., a ten days' course in the gunnery ship, the annual firing when abroad, and whenever the men are exercised at manning ship.

Special inducements might be given to men to shoot well, such as a penny or twopence a day extra. The idlers would do for ammunition men; therefore it would be hardly worth teaching any of them the use of a rifle.

The remarks we made with regard to the Officers of the Royal Naval Reserve will apply to the men, except that it is not so necessary that they should serve on board of a man-of-war even in peace-time.

CHAPTER II.—*Construction and Protection of Matériel.*

This is a subject which seems at present to be left rather too much to the Constructor's Department, and instead of naval Officers being first asked what kind of ships they require, the constructors seem to be left to build the ships, while we have to fight and make the best of them. We would humbly suggest that there should be a Board of naval Officers appointed to arrange what are the best types of ships that should be built, and to examine the drawings, &c., to see if they meet their views, and make whatever alterations they may deem desirable, in consultation with the constructors, subject of course to the approval of the Controller of the Navy and the Lords of the Admiralty (the former might be the President of the Board).

In a Navy like ours which has such various duties to perform, it seems important that we should have ships built for certain duties, and if possible at the same time able to perform other duties, and we would recommend that ironclads should be divided into three classes, each class intended to do some particular kind of work.

The classes might be—

1st. Line-of-battle or fleet ships.

2nd. Ironclads of lighter draught and not so powerful (specially intended for going through the Suez Canal or for bombarding forts).

3rd. Coast defence ironclads.

The 2nd class of ironclads seems to have been rather forgotten lately, which is perhaps a mistake, as at any time it may be very important to concentrate a powerful fleet in the East, particularly owing to the increasing fleets of both Russia and France in the China Seas;

and now that Germany is also beginning to have interests in Eastern waters, she will no doubt always keep a fleet in those waters. This was also shown at Alexandria, where out of the whole Mediterranean Fleet we could only bring two ships into the inner harbour (viz., the "Invincible" and "Monarch") to bombard the forts, and an obsolete ironclad like the "Penelope," which was supposed to be guarding our own coast, had to be sent out to augment the fleet.

Now of late years, since the "Iron Duke" and the "Audacious" were built, the "Shannon," "Nelson," "Northampton," "Ajax," and "Agamemnon" are the only ironclads that have been built to augment this class—the two last of these ships, however, are notably bad ships for steering—these are about the only new ships that are able to go through the Canal.

First. Ironclads for the line of battle.—The "Admiral" class are the ships at present being built to augment this class, they answer the requirements fairly well, only there are a great many things about their construction, as well as about the construction of the "Inflexible," "Colossus," "Ajax," and "Agamemnon," which have never been practically tried, and which many naval Officers who are well capable of expressing an opinion do not believe in, and therefore it seems advisable that they should be tried before any more ships are built like them. It is the much-discussed question of the unarmoured ends, which as Captain Fitzgerald and Sir Edward Reed point out very clearly has been very much modified by the introduction of machine-gun fire, and if, as they point out, the water-line is riddled and the ships are not safe under those conditions, it would certainly seem advisable to modify this to some extent, as what is the use of having an impenetrable citadel, if its floating power is removed from it?

Therefore we should recommend that this should be fully tried, and in the meantime either no new ships should be laid down at all, or the ships that are laid down be designed with a complete water-line belt, which we would very much prefer, like the "Amiral Duperré's;" if the belt be made sufficiently thick, weight might be taken off by only having an armoured deck over the vitals of a ship, except in ships intended for bombarding, which ships should have a specially thick armoured deck to protect them against plunging fire.

The belt ought at all events to be thick enough to protect the water-line against quick-firing guns, say 4 inches of armouring, then a complete armoured deck would still be required; the extra weight might be taken off the armouring of the vital parts, or better still, the tonnage of ships, if absolutely necessary, might be increased to allow for the extra armouring.

The barbette principle for firing large guns we believe is the best one, only the barbettes in the "Admiral" class of ships are not sufficiently protected from the plunging fire from the enemy's tops, and if the hurricane deck were extended and protected with 2-inch armour immediately over the barbette, it would prove a great protection to the men in the barbette. The French recognize this, and the barbettes of the "Amiral Duperré" are protected by an armoured hurricane-deck.

The barbettes should be armoured with thick armour all round, and the tubes leading to them also, so as to prevent them being easily disabled.

The main deck battery of 6-inch guns is a great improvement over the original armament of the "Inflexible," with her four huge guns which took a long time to load, and the defects of which were fully shown at Alexandria.

The conning towers should be well protected as they are at present, and the different firing keys and fittings in them should be made as simple and easy to distinguish as possible. Now many of our conning towers would be a perfect puzzle in a general engagement; simplicity should be more considered in fitting them up.

These ships have a good many machine-guns, but so many different types are being introduced into the Service, that the supply of ammunition for them all will prove a considerable difficulty.

Each of these ships should have at least six Whitehead discharges. One forward in line with the stem, but clear of the ram, one aft over the stern, so as to shoot a torpedo between the wakes of the two screws, and two on each broadside, with the new Mark V carriages fitted to train from 75° before or abaft the beam to 10° abaft or before the beam. We are very much surprised that one of our most modern ships, viz., the "Colossus," has only two Whitehead discharges, this in the present day seems an important defect, and all ironclads should have at least four Whitehead discharges. A great step in the right direction has been made in doing away with masts and yards in these ships, and substituting in their place military masts; it seems questionable whether another top to each mast would not be an improvement, on account of the increasing importance of machine-gun fire from ships' tops; for the same reason it is a matter for consideration whether a small armoured tower should not be built for signalmen to be able to work in during an engagement between fleets, as now it would be impossible for them to remain on deck, when within short range of the enemy; the signal halyards could easily be worked through slits in the top of the tower, and the flags could be stowed in lockers placed round the inside of the tower. These ships should also be fitted with a complete and very efficient net defence.

If turret-ships are again built, the "Dreadnought" class should be copied in preference to the "Inflexible" class, particularly with regard to the positions of the turrets and the armoured belt, the "Dreadnought" being generally considered one of our most successful modern ships.

We now come to consider what duties the 1st class ironclads are expected to fulfil. Their principal duty is to form part of the different fleets we may require, which are at present the Mediterranean, Channel, and the Reserve Fleets (the Reserve Fleet, if our coast were properly defended by coast defence vessels, would be able to form a Channel Fleet, leaving the Channel Fleet free to go anywhere it was required), and perhaps one of the 1st class ironclads might be wanted to go out on some station where any foreign nation had a more powerful ironclad than any of our 2nd class ironclads.

The ironclads would therefore require a high speed, in order to cope with any foreign fleets with high speed they might have to encounter; their speed should not be less than $15\frac{1}{2}$ to 16 knots, they will not want an abnormally large coal capacity, as they would not be expected to go very far from where we have coaling stations, but it always must be remembered that they trust to steam alone; their coal capacity, therefore, should be very considerable, say at least six days at full speed.

They should always be fitted with twin screws, steam steering gear, electric search lights, and lighted internally by electricity.

At present not enough care is taken to ventilate certain parts of the ship, the dynamo room is nearly always badly ventilated, which is most injurious to the machines, as it tends to melt the insulation of the wires; there should be very little excuse for this, as a fan could be put on the same shaft as the armature of the machine, which would at all events circulate the air well. In the "Colossus" the hydraulic room and the dynamo room are intensely hot. The electric search lights in all ships should be placed very low, instead of very high as at present, and an arrangement has been recommended to work it out of a main-deck port, which should be tried and fitted.

The 2nd class of ironclads should take the place of what are usually called 2nd class ironclads, these merely being built either as small ironclads, or have become obsolete, originally being 1st class, without reference to their draught of water. The 2nd class ironclads we hold should be built either for foreign stations, or for bombarding forts which are surrounded with shallow water, but for whichever purpose they should draw little water.

In size they should be smaller than the line-of-battle ironclads, but might be built according to the same idea, that is to carry, say, two heavy guns in armoured barbette towers, and several smaller guns in an unarmoured battery, have an armoured belted water-line, very large coal capacity, rigged so that in case of coal running short to be able to cruise about fairly well under sail, should be fitted with a complete net defence; electric search light (placed low as before); internal lighting would be a great advantage when under steam, but it is questionable whether it would not be considered too expensive, as it could not always be used. These ships should have room to carry a larger number of mines than at present, as they may at any time get disabled, and have to take refuge in a harbour, so that we would propose that twenty-four instead of six should be carried, besides the countermines. The ones intended specially for bombarding forts should have a complete armoured deck, and thicker than usual, some of the armour being taken off the sides if necessary.

The coast defence ironclads of late years seem to have been rather neglected, none having been built since 1872, and then only six; it therefore seems time that some more were built; besides these we have about thirty gunboats of the "Bloodhound" class and a dozen of the "Medina" class, but several of these are abroad defending a few of our coaling stations, but from their usual be-

haviour in a seaway we can hardly look on them as very satisfactory to defend the coast, although they may be very good for defending certain harbours, where they would be in more or less smooth water. In going round to join the Evolutionary Squadron, the fleet were delayed about ten days waiting for the gunboats, they being weather-bound; this points to the fact they are too small for coast defence, and we would recommend for the defence of the coast a mean between the coast defence ironclad and these small gunboats.

A coast defence vessel should possess the following qualifications:—
1. Light draught; 2. Handy; 3. Able to steam from port to port with safety in bad weather; 4. Good guns; 5. A fair speed and ordinary coal capacity; the speed and coal capacity being secondary considerations.

We would recommend gun-vessels of the “Wespe” type, which is a type of gun-vessel built by the Germans for the defence of their coast. They are 142 feet long and have 35 feet beam, and in Germany are armed with a 12-inch 36-ton gun, for which we would substitute a 43-ton gun, mounted in an open circular breastwork, and protected with 8-inch plating; besides the large gun they should have one or two 5-inch B.L. guns aft, and several machine-guns; they have twin screws and steam steering gear.

These gun-vessels would be more what we require than anything we have at present, and are necessary for the defence of our military ports, coaling stations, and the principal commercial ports. They should be stationed at their ports during peace-time, so as always to be ready for any emergency.

Besides these three different kinds of ironclads, owing to the introduction of the Whitehead torpedo, another type is now required, called a torpedo ram. These craft should be very fast, should possess quick turning power, numerous Whitehead discharges, be unsinkable, and almost entirely submerged.

The “Polyphemus” answers these conditions very well, and has proved herself a great success, therefore it seems very important that more ships of her type should be built, so that one or perhaps two “Polyphemus’s” might be attached to each fleet.

The “Scout” class answer these conditions to a certain extent, but they do not seem to be unsinkable, and are very much exposed to hostile fire, besides not being able to steam quite fast enough, but would no doubt be an acquisition to any fleet.

We next come to the unarmoured ships, which might be divided into the following different classes:—

1. Swift cruisers and despatch vessels; 2. Corvettes; 3. Sloops; 4. Gun-vessels; 5. Torpedo dépôt ships; 6. Armed merchant ships.

boats, and hoist them out at sea; 5th. Handiness; 6th. Manœuvring power under sail.

We have put handiness very low down in the list of requirements, as they will never form part of the line of battle, therefore it is not so much required, and too much seems to have been sacrificed for it in many of our cruisers, such as the "Iris," "Mercury," "Leander," &c., and if we consider what duties they are expected to perform, viz., 1st. Protect our trade; 2nd. To attack and destroy the enemy's cruisers and armed merchantmen; 3rd. To act as the eyes of a fleet, and convoy some of the torpedo-boats during an action; it does not appear that we want a particularly handy ship, but we do want a very fast ship, at the same time being an economical steamer, possessing a large coal capacity and very good offensive powers.

Now it is generally found that one of the best ways to get great speed, and at the same time economy, is to make ships very long, with of course good lines, which at the same time allows a larger space for coal.

Therefore we would recommend that instead of limiting the length of these ships to 300 feet between the perpendiculars, it might be advantageously increased to 350 feet.

This would no doubt enable them to steam at least an ocean full-speed of 18 knots, and this without any fear of a breakdown, or wanting a great number of extra men as coal trimmers, as is we believe the case in the "Iris" when going full speed.

Their coal capacity, instead of being 750 tons, which is all the "Iris" carries, should be much larger.

These cruisers should be fitted with twin screws, their engines and vital parts should be protected with a 2-inch armoured deck, should carry a large number of 6-inch guns and machine-guns, should have four Whitehead discharges on the beam, and if possible one over the stern, carry two torpedo-boats, their rig should be light sufficient to be able to cruise about under sail, and with fires banked if required. Besides these larger despatch vessels, of which we ought to possess several, we come to the despatch vessels, which should possess an ocean speed of at least $16\frac{1}{2}$ knots, of the "Leander" type; the "Surprise" and the "Alacrity" are going to be armed, and will make very formidable despatch vessels, but we should think they have hardly enough room and beam to carry a large armament, but they are a decided advance on the few unarmed despatch vessels we possess at present.

2. *Corvettes.*

We want a large number of this class of vessel for our foreign stations, but at present most of them are not fast enough to be of much use to protect our merchantmen.

They seem to labour under the same disadvantage as our swift cruisers, that is, that they are not long enough to develop a large and economical speed, and in this respect it is considered by many Officers that our smaller vessels particularly are not as good sea boats

or do not steam nearly as well as those of some of the other European nations.

Thus the C class, the latest type of corvette being built, are only 225 feet long, and have a speed of only 13 knots, which is less than the speed of many ironclads, and thus they would fall an easy prey if they met an ironclad. We think these ships should have at least a speed of 15 knots and ought to be better sea boats, therefore they might be made a little longer, as now they are extremely short. The ones that are armed with B.L. guns are very formidable opponents, besides having two Whitehead discharges, which all corvettes should have now. They also are very well divided into numerous watertight compartments.

3. *Sloops and Gun-vessels.*

The great complaint against some of these vessels is their small speed and their being bad sea boats ; but some of the newer sloops are better in these respects, and the gun-vessels and gunboats are being better constructed, as it seems worse than useless to own gunboats which can hardly steam 4 knots, which is about the speed of some few of our older gunboats, partly no doubt being due to the bad state of the boilers.

4. *Torpedo Depot Ships.*

The torpedo dépôt ship is quite a new requirement, and every year is becoming a more necessary addition to a fleet.

We only possess one of these vessels at present, viz., the "Hecla," but we believe the drawings are made out for another.

A torpedo dépôt ship should possess the following qualifications :—

1st. Speed of at least 16 knots.

2nd. Large stowage capacity for coal, mines, cables, &c.

3rd. Ability to carry 1st as well as 2nd class torpedo-boats, with very good appliances for hoisting them out at sea.

4th. Good workshops sufficient to keep the torpedo-boats of a fleet in good order.

5th. A few 5-inch B.L. guns and a large number of quick-firing guns.

6th. Several Whitehead discharges, particularly one right astern.

One of these ships should be attached to every fleet, and where the fleet consists of over nine ships, there should be two of them.

This was shown at Bantry Bay, where the "Hecla" had to supply gear for all the ships, besides having to coal, water, and generally look after the torpedo-boats : this was too much for one ship to do.

We have placed speed first in the list of qualifications, as with six or eight torpedo-boats, and a large amount of mining stores, they would be a valuable prize for an enemy's cruizer to take ; besides speed is very necessary for them, in order that they could be used to carry torpedo-boats for a torpedo-boat attack, if it were required to make an attack on some distant port, as being fast, they could come off a port after dark, hoist out all their torpedo-boats, send them in, with orders for the boats to meet the ship at a certain rendezvous after the attack

has been made, then hoist them in again, and having good speed need not much fear being captured.

The "Constantine" in the Russo-Turkish War performed this duty very well, and without a ship of that type the various attacks on the Turkish ships in different ports could not have been so easily carried out. Although now the new boats that are being built are 125 feet long and are supposed to be able to keep the sea; besides being too large to hoist in; but for a long cruise it would be advisable they should be convoyed, in case of any of them breaking down, these would be very suitable ships to perform this duty.

5. *Armed Merchant Steamers.*

With a large mercantile marine like that we possess, we ought to be able to find a fair proportion of fast steamers possessing the necessary requirements to enable them to be armed and used to protect the commerce, and in fact at present we have at least 400 on the Admiralty List which are fit to be armed and used as armed cruisers; 100 of them being able to steam more than 13 knots. Since the idea was first started, we believe the large shipowners have been only too ready to build their new ships according to the Admiralty requirements.

Now in time of war our commerce is the great national weakness, and it is one of the great questions how we should efficiently defend it, and the first thing we have to consider is what ships we should use to defend it with.

Of course there can be no question that to have a large number of fast cruisers belonging to the Service would be the best way, if they were kept up to the latest requirements, but there are various things to be considered, which modify this view.

The first, which unfortunately has always to be considered, is the great expense to build a sufficiently large number of fast cruisers, and secondly, again the expense of keeping them up to date, and the different improvements this would entail.

Therefore for these reasons we must trust to arming the best of our merchant steamers, which method possesses the following advantages:—

1st. They do not cost anything in time of peace.

2nd. Amongst the large steam ship companies there is a great deal of competition, therefore the new steamers that are built are always of the best kind, and every improvement is introduced to give them good speed and at the same time to make them more economical steamers.

3rd. As there are fittings and guns sent out to certain depôts abroad, these steamers can be hired abroad, and sent to these depôts to arm when required; whereas if we trusted to our own cruisers they would most probably be at home and paid off, thus valuable time would be lost in fitting them out and sending them abroad.

4th. Being generally larger and possessing large hold space, they are able to carry a large quantity of coal, thus being able to keep the sea

for a long time. There are, however, several disadvantages in hiring merchant steamers, instead of possessing a sufficient number of our own cruisers, viz. :—

1st. As the Admiralty List includes most of the finest steamers, it takes away a certain number of steamers that are better able to defend themselves than the slower steamers, besides crippling to a certain extent the mail service, which becomes very important during war time.

2nd. That the steamers are not ready like men-of-war should be, and from want of practice, the process of arming them takes a considerable time.

3rd. That many of their decks and even those on the Admiralty List are hardly strong enough to bear heavy guns.

Considering the above advantages and disadvantages, it is evident that the best thing is to trust to arming merchant steamers.

During the late preparations for war, sixteen steamers were hired for six months certain, varying from 17s. 6d. to 1l. 10s. per ton a month, including the crew being paid, or if the Government paid the crew, from 12s. 6d. to 1l. per ton. Most of these steamers were taken in hand and prepared for arming, but war not being declared, only one steamer, the "Oregon," was actually hired, and we believe answered very well.

Her armament was four 5-inch B.L. guns, and six 64-pr. muzzle-loading guns, which was the same as was intended for several of the others, and is a fairly good armament, particularly if the 64-pr. guns were fitted with a slide; truck guns are not suitable for merchant vessels, as they jump too much for the weak decks of merchantmen.

If better guns can be procured, 64-pr. guns ought not to be used at all, as they are very inefficient as compared with the modern guns, and unfortunately all the guns and fittings abroad are for 64-prs. This seems rather unfortunate, as an armed merchant steamer capable of steaming between 16 and 18 knots for a long time, and with a large capacity for coal, rivals most of our own cruisers, as they can only steam fast for a comparatively short time, on account of their limited bunkers; therefore it would seem advisable to give them a very good armament of the most modern guns, and a good many machine-guns instead of a net defence, which would hardly be required.

It is also most important that they should be armed very quickly, as on the first outbreak of war if we have not many cruisers to protect our merchantmen, we should be certain to lose a great number of ships if at war with a naval Power.

Now in England there ought to be no excuse about the ships not being armed quickly, because fittings should always be ready, and a plan for arming each ship should be made out during peace-time, then the only thing that would be required would be to fit the different things in place, and where the decks require to be strengthened that might be done, or arranged for while the ships are being built.

Abroad the case is different, as although the fittings are at the different depôts, in some places we believe there are not enough men

to fix them in place, and men have to be lent from the ships on the station.

This might be arranged otherwise, so that wherever there are fittings there should be sufficient men to put them in place, and to do it quickly.

Merchant steamers, besides having to be armed, would be required for several other duties, viz., as transports, colliers, store ships, extra torpedo depôt ships, telegraph ships for laying and repairing telegraph cables.

A great number of steamers would be required as colliers, and it is important that they should be fairly fast, as a means of protection, and besides should be fitted with some arrangement for coaling ships at sea; this would be one of the most important duties for a collier to be able to do, as we imagine every fleet will have some colliers attached to it, according to the particular kind of work it is doing, and particularly if it is blockading an enemy's coast, as it would be almost impossible to be always sending ships away to the nearest port for coal.

Several different proposals have been made by Officers, and it seems very important that one of these plans should be tried, as the expense would be very trifling. What is required is speed in coaling, and the ability to coal a ship while she is under weigh, as in a large fleet the delay would be very considerable if it had to stop for each ship to coal.

A certain number of telegraph steamers will be required in war-time, in order to repair telegraph lines and lay down fresh ones, and it becomes a matter worthy of consideration how we are to defend them, as if an enemy's cruiser caught them unarmed while laying a cable, they would stand a small chance without they cut the cable and ran. It would, perhaps, be a mistake to arm them, but when they are likely to meet an enemy's cruiser they would either have to be convoyed or armed. We are inclined to think convoying in these special cases would be best.

We have now to consider more particularly the external defence necessitated by the introduction of the torpedo and submarine mine.

First, all ships down to the smallest gunboat should be fitted with a complete and efficient net defence.

This is the best and probably the only efficient way of satisfactorily defending a ship against Whitehead torpedoes.

Now a good net defence should possess the following qualifications:—

1. It should be rigged altogether from inboard, without using any boats.

2. Should be rigged and unrigged very quickly.

3. The topping lifts and guys should be clear of the fire of the guns.

4. The ship should be able to steam at least 5 knots with the nets out, and be able to keep the nets out in moderately rough weather.

Several different plans of net defence have been tried in different

ships, but the defence of the "Dreadnought" seems at present to be the best, and all turret ships are being fitted on this plan.

The fourth qualification is at present a difficult one, as when a ship is under weigh, the bow and stern defences are very difficult to keep in place, the bow defence tending to sag in towards the ship, and the stern defence gets washed to the surface; but now that ships are defended completely this ought to be overcome better.

Second, machine-guns, which we have mentioned before, should be fitted to all ships, their number and positions varying according to the size of the ship.

It is hardly necessary to point out the advantages of machine-gun fire in the day time for repelling a torpedo-boat attack; but at night it is questionable whether they are of very much use; this question will no doubt be fully tried in the "Polyphemus."

Third, the electric search light.

All large ships should be fitted with a dynamo that will burn at least two search lights at once, and the projectors should be placed in the main deck ports, and the lamp should be automatic, the projector manipulated from a distance, as if this could be devised it would be an improvement on the present arrangement, as now the operator manipulates the lamp and projector close to it, where he cannot see anything, and has to be directed by some one at a distance; very often he moves the projector too far, and thus misses the boat.

Corvettes and all smaller ships should be fitted with a dynamo, to burn one light at a time, and either one or two projectors, according to the size of the ship, which should be placed as low as possible, and clear of all obstructions.

Several different methods have been proposed to be adopted in the construction of our ships, to prevent the bottom being penetrated by torpedoes. Of course the protection we adopt in the construction of our ships is watertight compartments, by subdividing a ship into as many compartments as possible, and so reducing the chances of destruction to a minimum; but during the last two or three years the charges used in the Whitehead torpedoes have increased from 30 lbs. to 65 lbs., and in the 19-foot torpedo to 94 lbs.; it becomes therefore a matter for consideration whether some other means besides watertight compartments should not be adopted to prevent ships being destroyed by torpedoes.

Sir Edward Reed recommends that ships should have an armoured inner skin to prevent the explosion of a torpedo penetrating both bottoms. This seems worthy of trial, and experiments might be carried out to prove if it is an improvement on the present arrangement; a small ship might be fitted, like the "Oberon" was, except that it should have an armoured inner skin, and if it proved satisfactory a larger ship might be tried. Of course the great objection to this system is the extra weight, which would have to be taken off the armour above water, but it would be by no means thrown away.

There is another proposal to cover a ship's outer bottom with india-rubber or canvas, which answers very fairly well when tried with boats; but the great objection to it is the chance of it deteriorating, and it would increase the skin resistance of a ship.

CHAPTER III.—*Attack and Defence of Ships.*

It is generally advisable when trying to master a subject, first of all to see what we can pick up from the experience gained by our forefathers, but unfortunately in this subject, under the altered conditions of naval warfare since the introduction of steam and torpedoes, we have very little of this experience to refer to, as fortunately for ourselves we have not been engaged in any naval war since our ships have been propelled by steam as in the Crimean War, our ships hardly ever met a Russian ship at sea, two of our smaller ships, however, felt what a submarine mine was like, luckily the charge was only 20 lbs. of powder, or otherwise they would have been totally destroyed.

It is not generally known that torpedoes were used against our ships as long ago as the War of Independence with America, and also in the last war with that country in 1812, but with no serious results, except a prize schooner was destroyed by a torpedo which had missed the ship, which one of the men got hold of and was examining when it exploded and destroyed the schooner, also one of our ships got her forechains blown away, and had a boat destroyed by another torpedo.

Fulton also tried to use them against our ships during the last war we had with France, but with no success.

These few attempts in no way influenced our tactics, except to make our Officers look out for these new hidden dangers, so that in our own history we have nothing to learn about the attack and defence of ships since the introduction of steam and torpedoes. When we look abroad, there have only been three naval actions between fleets during this period, the best known of these being the Battle of Lissa between the Austrians and the Italians. The lessons we may learn from this action are as follows:—

1st. Single column line ahead in open order (particularly when the ships are not in station) is a bad formation to receive an attack from another fleet.

2nd. That ramming is by no means so easy as it is very often supposed to be, as if the enemy is on the alert it can be very often avoided by the helm, even at the last. Thus the “Ferdinand Max” made two attempts to ram two different ships; both were avoided by the use of the helm, but the third attempt, against the “Re d’Italia,” was successful; she rammed her under the counter and sank her, but it should always be remembered that the “Re d’Italia” was at the time surrounded by three other Austrian ships, which must have prevented her from manœuvring to prevent being rammed.

3rd. To ram a ship, the rammer must have good speed and good steering gear, which was practically shown by the two ineffectual attempts of the Italian ship “Affondatore” to ram two of the Austrian ships.

4th. Ships that intend to ram, or are liable to be rammed, should have no projections from the ship’s side, as was shown by the “Re di Portogalo’s” attempt to ram the “Kaiser Max,” which the latter

avoided by turning towards the former ship and going full speed, in consequence of which the ships rubbed sides, and brought down the "Kaiser's" foremast.

This is a matter which we ought to think about, as many of our ships have projecting sponsons, to enable guns to be fired either ahead or astern, and all ships will be armed with very long breech-loading guns, which will not be able to run in far enough to prevent the muzzle projecting beyond the ship's side; consider what would be the effect of two ships rubbing sides with all the guns of one of them being run out. We think that there could hardly be a doubt but that they would be all dismounted. Thus what would otherwise have been a harmless rub has dismounted one broadside of guns. Are the sponsons made strong enough to be able to stand two ships rubbing sides? If they are, and they project a little more than the muzzles of the guns when they are run out, we have solved the difficulty.

The next naval action between two fleets was the Battle of Heligoland, between the Austrian and the Danish fleets, but it was undecisive, one wooden ship only being set on fire.

The third was between two gunboat flotillas, on the Mississippi; the Confederates came off worst; several were rammed and sunk on each side.

Also in an engagement between a ram and several wooden ships, two sailing frigates and a gunboat were sunk by Confederate rams, and several ships were disabled by shots through their boilers; there were also two or three ineffectual attempts to ram.

In the war between Chili and Peru, the "Huascar" made two attempts to ram the "Esmeralda," the "Esmeralda's" engines being disabled at the time; the cause of these failures was that the "Huascar's" engines were stopped too soon; the third attempt was, however, successful, and the "Esmeralda" was sunk. In the same action the "Independencia" made three attempts to ram the "Covadonga;" the fourth time, instead of ramming her, she ran on shore.

In the action between the "Huascar" and the "Cochrane" and "Blanco," the "Cochrane" made three attempts to ram the "Huascar." The "Huascar" at the time was very much disabled. The "Huascar" also made an attempt to ram the "Blanco," which the latter avoided by using her helm.

These are the results of the only engagements in which ramming has been used.

Torpedoes or torpedo-boats were not used in any of these actions, we have, therefore, no former experience to gather anything from relative to the use of torpedoes in actions between ships.

We have not mentioned anything about the damage the guns did in the different actions, as the art of gunnery, though it has improved enormously, has been nearly counterbalanced by the vast improvements made in the construction of ships.

Machine-guns were not used in any of these actions, except in the latter between the Chilians and the Peruvians, when the machine-guns in the tops of the "Cochrane" successfully cleared the

"Huascar's" upper deck; this points to the fact of some protection being given to signalmen, as we mentioned in the last chapter.

Before considering what tactics to adopt, it is advisable, first, to decide which of the three weapons (*viz.*, the gun, ram, or torpedo) is most effective, so that the tactics may be arranged in order to bring the best weapon into play to the greatest advantage.

Of course if the ship or fleet were badly armed with this particular weapon, the best would have to be made of the other two weapons, and tactics should be adopted so as to bring the best weapon of the two into play to the greatest advantage.

Most writers on naval tactics seem to place the ram as the first weapon of attack, and all tactics are made out with a view of ramming the enemy as soon as possible, and, if successful, bringing the action to a successful close. They recognize the gun as a very useful and powerful weapon; but the effect of a single shot, or even a broadside, is not nearly as effective as one ship merely drifting across another's bow, as was shown when the "Northumberland" parted her cable off Madeira, and drifted across the bows of the "Hercules," and far less so when a ship with a good speed rams another ship; for these reasons the ram has been placed before the gun.

But writers have hardly noticed the latest weapon which has been creeping into all the European navies, *viz.*, the Whitehead torpedo, they either ignore it, or say we have not had sufficient experience about torpedoes in warfare, or they are still very uncertain, but that probably they will be formidable weapons in a few years' time.

Now it seems to us that the time has arrived when the Whitehead torpedo should be considered in all manoeuvres between ships, and its effect is undoubtedly to diminish the fear of being rammed, and to very much increase the danger of ramming another ship which is fitted with them; so much so that Commander Gallwey, one of our best authorities about Whitehead torpedoes, holds the opinion that no ship will attempt to ram another ship fitted with them. The Officers in favour of ramming may consider this too sanguine, but if they believe in Whitehead torpedoes at all, they must see the great danger a ship runs of being seriously damaged before she is able to ram the enemy.

We have attempted to show this in the following diagram (Plate X, No. I). The ship is intended to be the "Rupert," which is fitted with four Whitehead discharges, capable of training from 75° abaft or before to 10° before or abaft the beam. The dotted circles show the dangerous zones, where a ship is liable to be hit by a Whitehead torpedo.¹

The only absolutely safe place to ram a ship like this is from right ahead, or from right astern; by a turn of the helm it would be perfectly easy to avoid it; this would also apply if attacking from ahead, only it is doubtful if a ship would dare move her helm if another ship were coming end-on at her, as directly the helm is moved the ship exposes her bow to be rammed.

¹ We have allowed 10° deflection when the carriages are trained either 10° before or abaft the beam.

If a ship missed ramming the "Rupert" and passed astern of her, as would probably be the case, she would be exposed to another torpedo being fired at her from her opposite quarter, at the same time showing a very large target at a short range, as is shown by the ship B in the diagram; the ship A is just coming into the dangerous position.

Ships that were fitted with torpedo discharges some years ago were either fitted with two or four discharges, but the carriages had a much more limited amount of training, very often only from 30° before to 15° abaft the beam, and allowing 10° deflection; the dangerous zone extends from 20° before to 25° abaft.

The diagram (No. II) represents a ship fitted with two of these discharges only, which would even prove a dangerous ship to ram, as the safest place to ram a ship is abaft the beam; this would compel a ship to pass through the dangerous zone.

Considering these two diagrams, it is apparent that the latter ship is not defended well enough with Whiteheads for an ironclad, but two discharges are very good for a corvette, and now most ironclads have four discharges, and, as we mentioned before, should have a bow and stern discharge as well, which would make a ship excessively dangerous to ram.

We have only been considering the Whitehead torpedo as a defence against being rammed, but by fitting the Whitehead torpedo to be discharged right ahead, it forms, besides being a very good defence, an excellent substitute for the ram and without one quarter of the danger, as ships so fitted would not attempt to ram, but would try and get an enemy to present as large a target as possible, and at a distance of 300 or 400 yards fire a torpedo from the tube right ahead, which if it hit would do the ship serious damage, and for the time probably demoralize the ship's company sufficiently to render ramming perfectly safe if it were thought necessary.

Therefore we hold that ramming is by no means the first weapon of offence, principally for the following reasons:—

1st. On account of the danger of being hit by a Whitehead torpedo.

2nd. As ramming is by no means successful the first time, and at each unsuccessful attempt, a ship runs a great risk of being either rammed or torpedoed.

From the experience gained in actual warfare and mentioned above, we find there were twenty attempts to ram, out of which only six were successful and totally destroyed the ships that were rammed, which means that 30 per cent. of the attempts to ram were successful. Now we unfortunately have no experience of torpedoes in actual warfare, except the few Whitehead attacks by the Russian boats against the Turks, and in one of the attacks they fired two Whitehead torpedoes at a revenue cutter which came in their way, and totally destroyed the cutter, which aroused the squadron, so that the boats had to beat a retreat. Hobart Pacha, we believe, denies this, but at all events the best evidence we have of the accuracy of Whitehead torpedoes is from the half-yearly reports of torpedo exercises of the Fleet.

Where a shot is considered successful, it strikes a ship of 200 feet long at 300 yards range.

In 1881, 80·2 per cent. of the shots fired were successful.

1882, 86·7 " " "

1883, 77·6 " " "

The percentage is lower in 1883, owing to the torpedo being fired in 97 cases over the range.

In 1883 nearly 1,000 shots were fired.

These figures point to the torpedo being accurate, and compare very favourably with the number of successful shots from guns.

In an action we could hardly expect 86 per cent. of the shots to be effective, as another error will come in, viz., the error in estimating the speed and course of the enemy, but even here a large error can be made, and still the ship will be hit.

For instance, if the speed of the torpedo be double the speed of the enemy, which it is, supposing the enemy to be steaming 10 knots, and now with the new torpedoes which travel 24 knots, the enemy might be steaming 12 knots.

Thus:—1. When the speed of the enemy is estimated correctly, a ship can be steering between 6 points outside her supposed course, and 2 points inside, and she would still be hit.

2. The speed can be over- or under-estimated as much as 2·5 knots.

3. If the speed be over-estimated, a ship can steer as much as 4 points outside her supposed course.

4. If the speed be under-estimated, a ship can steer as much as 3 points inside her supposed course. These give very broad limits for the great necessity for very great accuracy about the speed and course of the enemy, so we ought to make as nearly certain of hitting a ship in action as in hitting the target in peace-time, and probably we might consider that 50 per cent. of the shots would be effective at 300 yards range. Of course, as the distance increases the chances of a successful shot diminish, but 400 yards is considered a very good range to fire a Whitehead; outside of that it is not advisable to fire, if you think there will soon be a chance of getting a shot within the range, otherwise it is well worth trying up to 600 yards, its extreme range at present.

Having discussed the different advantages of the three weapons, we next have to decide which is the first weapon, and we are of the opinion that the introduction of the Whitehead torpedo has ousted the ram out of its former position, and given it the second place only, the gun at the same time becoming more on a level with the ram, as we hold that the ram will not often be used against ships which are properly fitted with Whitehead discharges; but the reason we have still placed it before the gun, is on account of its certain destruction to any ship it comes in contact with.

Where ships are not fitted with torpedoes, the ram still holds its old place, and the gun becomes relatively much inferior to it.

In any naval war we may be engaged in in the future, we are certain to have to fight ships provided with the Whitehead torpedo,

except at present with America, as all the principal European nations have armed their ships with torpedoes.

We have not mentioned any other offensive torpedoes, as the towing torpedo is practically abolished in all navies, the French being about the last to use it; also the spar torpedo on the broadside is abolished in our Service, although we believe the Americans still use it.

We will now discuss the different tactics that should be adopted, first in an action between single ships, and then in an action between two fleets.

An Action between single Ships.—1. We have assumed two ships meeting each other nearly end-on, having an equal speed of 10 knots, both ships having Whitehead discharges, but B having one right ahead as well, which A does not possess, B's right ahead Whitehead discharge being above water and clear of the ram.

B's tactics are to try and fire a Whitehead from right ahead, and if advisable to follow it up with the ram (No. III).

A tries to pass B at 600 yards distance, but B possessing the right ahead discharge, ports her helm and bears down towards A.

When A arrives at 3, if A knows that B has a right-ahead discharge, A should starboard her helm, and keep away from B, until at 6. A will be able to fire a Whitehead at B at 600 yards range, which should hit B at *b*, but B directly he sees the Whitehead fired should put his helm hard a-starboard, stop the engines or reverse one propeller (if fitted with twin screws); if this is done in time, the Whitehead will pass harmlessly ahead. A after firing the Whitehead, and seeing B turning towards him, should put his helm hard a-starboard and keep B bearing on his quarter, and if possible increase speed, so as to be able to manœuvre across B's bow, keeping out of range of his right-ahead discharge.

This is about his only chance of not being hit by B's torpedoes, as we have tried to show by the courses, &c. (in dotted lines). Thus if A when at 3 did not know B had a right-ahead discharge, and thought he would keep on his course, and cross B's bow sufficiently far ahead to prevent being rammed, when B arrived at 5, he could fire a torpedo at A at 330 yards range, A at the time showing his whole broadside, while A could at the same time also fire a torpedo at B, but B is only end-on.

If B fired his torpedo and A saw it, he should at once put his helm hard aport and stop the engines, if this were done in time the torpedo would pass harmlessly ahead of A, but if B at the same time as he discharged the torpedo righted his helm, he would be able to ram A just before the beam at 6.

If B, however, did not right his helm, and tried to pass ahead of A, or even if he kept his helm hard over, B would lose his advantage, and would be either rammed at B', or would allow A to get within his circle, while he was outside of A's circle, so it is most important for B to follow up his advantage in this case by ramming A.

We will again attempt to show that A should make a running fight.

As suppose at 7 A tried to cross B's bow and fire another torpedo at her starboard side, directly B observed this, he should starboard his helm, and when he arrived at 9 fire a Whitehead from right ahead at 420 yards range, which would hit A at a' , unless A turned as we mentioned before, B would probably be able to follow this up with a successful ram. In this case we have tried to show that a ship with a Whitehead discharge right ahead has a great advantage over another with Whitehead discharges on the beam only.

We have not yet mentioned when the guns should be fired or how. Many Officers consider it a mistake to open fire with the guns too early in an action, as they obscure the enemy and hide what his movements may be, besides firing beyond a certain distance becomes very uncertain. Therefore we would hardly recommend firing being commenced before the ships arrive at 3, when the ships are about 1,400 yards apart, and should be independent firing at first, broadside firing being reserved for when the ships pass fairly close to each other. We have not mentioned about torpedo-boats, with which in our days every ironclad is provided, or ought to be provided.

These boats should, if possible, be hoisted out, and kept under the off-quarter of their own ship, then when the enemy attempts to ram her, they should pounce out and fire a torpedo at her. No doubt they would get other opportunities under cover of the smoke of attacking the enemy, but it is useless to send a torpedo-boat, when there is no smoke, to attack a ship, as she is certain to be destroyed. It is very important to have them hoisted out, as if inboard they would be riddled with bullets, and thus rendered useless. In this and the following cases we have mentioned what a ship should do if she saw a torpedo coming towards her, but it must always be remembered, it will probably be only the exception when a ship will see a torpedo coming at her, at all events in time to be able to turn and avoid it.

2. We have assumed two ships of equal speed, as before, but B, instead of possessing a right-ahead discharge, has one right astern, both ships possess the ordinary broadside discharges, but cannot fire their torpedoes before 15° before the beam.

B's tactics will be to try and cross A's bow at a safe distance to prevent being rammed, and then to fire torpedoes at A from her beam and stern discharges, as shown in (No. IV, Fig. 1).

If A allowed this, B at B' could fire a torpedo from his broadside discharge at 150 yards range, and from his stern discharge at 220 yards range, A each time presenting a very large target.

No doubt if A knew B had a stern discharge, or even only the broadside discharges, he would try and prevent B crossing his bow, and would probably starboard his helm, as shown in Fig. 2, and at 4, if B did not alter his course, he would be able to fire a Whitehead at B, which B would not have allowed, as at 2 he should have ported his helm, and tried to run a more or less parallel course, but keeping out of range of A's torpedoes.

A would have rather the advantage of the position, but if he tried

to close, and B kept edging away, he would lose it, without perhaps getting close enough for a shot.

In this case the action would be probably decided by the gun, without either ship went in for ramming, or one of the ships made a stern fight, which perhaps would be best for B, particularly if B has a good stern-fire, but it is doubtful if A would approach near enough for B to get a shot at her from her stern discharge.

3. We have considered an action between the "Polyphemus" steaming 16 knots and an ironclad steaming 12 knots with broadside Whitehead discharges only, but the carriages are able to train 75° before or abaft the beam (No. V).

The tactics the "Polyphemus" would probably adopt is to get within 600 yards of the ironclad, fire a torpedo from her submerged tube, and if possible ram her opponent afterwards.

The ironclad's tactics would be to make a running fight as long as possible, use her guns as much as possible to try and damage the "Polyphemus," which would be a very difficult undertaking, as end on she would be very difficult to hit. Then, when the "Polyphemus" was getting very close, to turn either way, and fire a torpedo from one of the after-carriages, and, if possible, afterwards to try and do the same with the other carriage; this would be the ironclad's only chance of escape, as the "Polyphemus" must overtake the ironclad, and will therefore be able to fire from her submerged tube, and ram the ironclad when she does overtake her. We have tried to show this in the diagram: we have imagined the "Polyphemus" has approached within 1,200 yards of the ironclad, about two minutes afterwards the "Polyphemus" will be only 900 yards directly astern, the ironclad starboards her helm, and at 3 fires a torpedo from her port after-carriage which should hit the "Polyphemus" at P'; the "Polyphemus" directly she saw the ironclad turn would probably be aware of the reason, and would be on the look-out for a torpedo being fired, and directly it is fired, the "Polyphemus" should turn towards it, and it would be comparatively easy to keep clear of it, as she would only have to turn a little before she would be out of the track of the torpedo. The ironclad should right her helm directly the torpedo was fired, and try if possible to fire a torpedo from her starboard after-carriage, but this is an impossibility, as if she tried to turn either at 4 or 5, she could not get the training on, so her only chance is to go straight on, and trust to her guns damaging the "Polyphemus's" engines; if not, at 7 or 8, the "Polyphemus" will be able to fire a torpedo from her submerged tube, and at 9 would ram the ironclad under the stern, without A exposed his quarter with the hopes of getting another shot, which he would hardly think of doing.

In the above case we think the "Polyphemus" would have much the best of an action with the ironclad, but supposing the ironclad has a right-astern discharge as well, the "Polyphemus" will find it very difficult to get within range if the ironclad made it a running fight, which no doubt should be her tactics.

No. VI is intended to show this; the "Polyphemus" is chasing the

ironclad, but should be careful not to get within range of A's stern or broadside discharges.

The "Polyphemus" will gain considerably, and if A allows her to approach just out of torpedo-range and get before her beam, the "Polyphemus" would have considerably the best position, as at any moment she could put her helm hard over, and turn towards A, fire her torpedo, and if she liked try and ram A, but we have hardly thought A would allow this case to happen.

But instead, A should, when the "Polyphemus" bears before a couple of points abaft the beam, turn away from her and steer a course immediately away from her; the "Polyphemus" would also turn, but would have to go through the same thing as before, that is, to try and get before A's beam, out of range of A's torpedoes, but when the "Polyphemus" got to about the same position, A should turn again, this could be repeated as many times as necessary, the "Polyphemus" being all the time absolutely harmless, while A could keep up a steady fire at her.

The "Polyphemus" could always withdraw from the action whenever she liked, but if the ironclad A adopted these tactics she could not harm the "Polyphemus."

Of course if the ironclad went in for ramming, the "Polyphemus" would soon get the best of the action, because of her superior speed and right-ahead discharge.

The "Scout" class could not keep up an action like this, as they are vulnerable above water, which will prevent them from being as useful as the "Polyphemus."

If these diagrams are correct, it would seem very advisable to fit right-astern discharges to our ironclads, as we recommended in the last chapter.

We have not considered an action between rams only, without any torpedo discharges, as they are hardly likely to be met with in any future war, and so many much more experienced Officers have fully discussed the different methods of fighting these actions, that it would be a mere repetition of their views.

An Action between Fleets.—This is an even more difficult subject than an action between single ships; as mentioned before we have no practical experience to guide us, and there are a great number of different ideas expressed by different Officers.

Some believe the gun is the first weapon in a fleet action, and that ramming will only be tried when an opportunity occurs; hardly anyone seems to have thought much about the place of the torpedo in a future fleet action, except, perhaps, the editor of the *Battle of Port Saïd*, where they are supposed to be used, and also numerous torpedo-boats; several of the ships are supposed to be destroyed by them.

The prevailing idea of a naval battle is two fleets charging at each other, using their guns, rams, and torpedoes as effectually as possible for the few seconds they are in contact, then re-forming and charging again, and so on.

But it seems questionable whether this method will always be adopted, now that torpedo-boats have come into use, and are attached

to all fleets. Might not these boats advantageously be sent under cover of a very heavy fire to throw the enemy's fleet into disorder, and possibly to destroy some of their ships? Then, having succeeded in their endeavour, the fleet might finish the required work. A fleet action seems particularly suitable for the use of torpedo-boats.

Next we want to know what order of formation to adopt for the fleet. Many Officers recommend line abreast, but it appears to us to be a bad formation for attack, as when the enemy's ships are passing through the line, if any of the projectiles which are intended to hit them do not, they will very probably hit one of the friendly ships.

The same also with their torpedoes, particularly if the ships are in close order, which they are usually supposed to be.

It is a difficult formation for ramming any of the enemy's ships, and is very extended.

Line ahead we think is a better formation than line abreast.

But we prefer the group formation to any of the other formations, as there is no chance of firing into one's friends, and there is a clear all-round fire from all the ships for both torpedoes and guns. It is besides a difficult formation to attack with the ram, and at the same time comparatively easy for either of the ships of a group to try and ram one of the enemy's ships.

The French peloton formation is recommended by some Officers, but it does not seem to be quite as good as our system of groups.

We have imagined two fleets of six ships steaming 10 knots meeting each other. Each fleet has hoisted out their torpedo-boats; we have assumed them to have nine torpedo-boats each.

One fleet, A, advances in groups (starboard group formation), No. 2 group forming in quarter line, A₄ being seven points abaft A₁ at six cables. The other fleet B advances in single column line ahead (No. VII).

A has his torpedo-boats in line ahead, while B has his under the off quarters of each of his ships.

We have imagined A to be trying to pass B's fleet at about four cables distance, and to engage the fleet with his guns, until when A gets nearly abreast of B, the torpedo-boats put their helms hard a-starboard together. The first four, with the intention of attacking B₁, turn through eight points, the other five do not turn so much (and should ease to pass under the others' stern), the 5th and 6th steer so as to attack B₃, while the last three boats steer so as to attack B₂, all the boats approach until they get within 300 yards, when if possible they should fire their Whiteheads, and we think it is very probable that B's 1st and 2nd ships would be most probably destroyed, as the boats would only be 1½ minutes under fire, part of which time they would probably be hidden by the smoke; the 5th and 6th boats would be rather longer under fire, so they might probably be both destroyed before they could fire at the 3rd ship, B₃.

The destruction of B's two leading ships (if it is effected) would no doubt seriously throw the fleet into confusion, and A's ships should at once take advantage of it, by turning and attacking B's fleet at shorter range, and if possible ramming some of his ships.

The machine-guns' crews should be warned particularly to try and

destroy B's torpedo-boats. A's ship should use independent firing as they pass, so as to make as much smoke as possible to hide the movements of their boats.

We have not yet considered what steps B should take to prevent his ships being destroyed.

He might, to begin with, try to approach near enough to be able to turn and try and ram A's ships, and if he were determined to have a closer action A could not well prevent it, but in this case the torpedo-boats should divide into two parts, each part protecting one group, and if B's ships try to ram, the torpedo-boats could turn and fire Whiteheads at them; A's ships trying to avoid being rammed, and at the same time trying to ram B's ships.

Or he might proceed, as we have shown in the diagram, with his boats under the off-quarters of the ships. Directly he saw A's boats coming towards his ships, he could send his boats to try and destroy them, but it is doubtful if they could do much in the $1\frac{1}{2}$ minutes, or he could turn together eight points to starboard, and thus show a smaller target and keep the boats longer under fire; this would seem to be the best, but even then the ships would not be able to go far before the boats would be able to fire their torpedoes at them. If these tactics were adopted by A, and B allowed them, we think A would be considerably the gainer, and much more so than if A's fleet charged B's, when directly the fleets meet, each fleet stands the same chance of losing ships, while in this case A has succeeded in destroying two out of B's six ships, and probably also has damaged some of B's torpedo-boats, whereas he has only lost some of his own torpedo-boats.

The damage done by the guns of the fleet will probably be about the same, and will depend on the training of the men, and the quality, size, and number of the guns.

2. If B's fleet, however, had been in line abreast (No. VIII), A could not have carried out these tactics so advantageously, and probably would not have wanted to do so, as this being an easy formation to attack directly, he would no doubt try that method in preference, and would form his fleet into groups in line ahead, dividing his torpedo-boats into two parts, one part being attached to each group, and stationed under the stern of the leader of the group, with orders that each part is to act together and go and attack the nearest ship, which the ships are not attacking, or not able to destroy. He would steer so as to pierce B's line towards one end, B could not easily prevent this, as if his fleet altered course together, A, having a much smaller front, could alter course also, and pierce the line at the point he wished, B's ships besides being in a bad position to prevent being rammed by A's ships, as they show their broadsides. Therefore, B's fleet would probably not try to prevent A's ships piercing his line where A wished. A's fleet are in a very good formation to prevent being rammed, while B's fleet are easy to ram, and in a bad formation to try and ram A's ships.

A would, therefore, make up his mind to adopt ramming tactics. It should be remembered that this is a different case to a single ship

action, so whenever two fleets charge each other, they must pass within range of the Whitehead torpedo, therefore ramming is not more dangerous than simple charging, as far as the torpedo is concerned, besides being always preferable to act on the offensive, if possible.

Therefore, in the diagram we have shown A's fleet trying to pierce B's line between B₂ and B₃.

A₁, when he gets within ramming distance, turns to port to try and ram B₂, A₂ and A₃ turning the same way but using less helm; B₂ directly he sees A₁ turn, should turn also to avoid being rammed, as if he went on he should be rammed at *a*. B₂ should starboard his helm, and about the best thing he can do is to steer so as to meet A₂ end-on, as if he puts his helm hard over, A₂ has only got to ease his helm, and will ram him on the beam, also if B₂ turns to starboard, A₃ will be able to ram him.

The torpedo-boats of the first group should be told off to go and attack B₁, and ought to be able to destroy him, A₃ engaging him with his port guns and torpedoes. A₄, the leader of the second group, when he arrives at 1, should turn to starboard so as to try and ram B₃, A₅ having also at the same time to try and prevent B₃ evading A₄'s ram. If B₃ goes straight on he will be rammed at *b*. If he puts his helm hard a-starboard, he will escape being rammed by either ship, but if he puts his helm over less, he will be rammed at *b'* by A₅, but should he escape these ships' rams, the torpedo-boats of the second group should be able to settle him.

We have not given A₆ anything particular to do, but he might go straight on, in case B₃ turns to starboard, and then he would get a chance of ramming B₃, A₆ would also engage B₁ with his port guns and torpedoes.

B has kept his torpedo-boats under his ships' quarters where they would be told to remain, except another ship attempted to ram their ship, when they should go full speed ahead, and try and destroy her; they might be able to destroy one of A's ships, but not being together they are liable to be sunk before they are able to do any damage.

A's ships should have destroyed three of B's ships B₁, B₂, B₃, but probably might have lost A₂, if she met B₂ end-on, and if one of B's boats are fortunate, another of A's ships might be destroyed, therefore B would have lost three ships, while A, perhaps, has lost two, but probably only one; B's other three ships have been no use to him at all, while A's ships have all been useful, which is one of the disadvantages of line abreast.

As the fleets are approaching, B's bow fire will be more powerful than A's, but until the fleets are about 2,000 yards apart, it is not of much good beginning firing, as the smoke hides what the enemy is doing, and does not do much good. When the ships approach, concentrated broadsides should be used, and every opportunity taken of firing Whitehead torpedoes.

After the fleets pass clear of each other after the first charge, they should reform as quickly as possible and charge again, any torpedo-

boats that are left should attack any disabled ships. B would most probably possess more of these boats and would have a slight advantage, but A ought to be able to look after their disabled ship or ships.

If B's fleet had been in any other formation than line abreast, we believe it would be for A to adopt similar tactics to those he adopted when B was in line ahead.

We have not space to consider all the different formations B might have been in, but have attempted by these two fundamental formations to show how A should attack them, using somewhat similar tactics for the others. We would always recommend our fleets to fight in groups, arranged in different ways according to what formation the enemy is in.

The torpedo-boats, if it is intended to act on the offensive, should be always kept together, as we have shown for A's torpedo-boats, but if the fleet is outnumbered and acting on the defensive, they should be kept on the quarters of each ship, as B has arranged for his boats. We have not yet discussed the position of the torpedo rams of a fleet, and it is very difficult to give them a position, but if they have great speed it would probably be better to leave them to act independently and to bring up the rear of the fleet, so as to be able to finish up any disabled ships, and to attack the fleet again while they are re-forming. If they have not very great speed, they had better take their place in the group, either as second or third ship; it would not do to make them first ship, as they have no guns.

We will next consider the duties of a fleet blockading an enemy's coast.

A blockading fleet would have to be composed of more ships than the enemy has in the harbour, otherwise it would be easy to raise the blockade any day that the defenders liked. It would have to be provided with plenty of torpedo-boats and torpedo-boat catchers, besides it would require torpedo dépôt ships to take charge of these boats, and also colliers which are able to coal the ships outside the harbour, without there were a well-protected harbour close at hand, like the Federal ships which were blocking Charleston had at Port Royal, only 60 miles from other former places, otherwise they could not have kept nearly such an efficient blockade. It will be very difficult in these days to maintain a blockade good enough to prevent some of the defender's ships escaping; but it will be very easy in most places to drop mechanical mines across the entrance, with the hope of destroying any ships which try to escape. These mines should be dropped at night, in order to prevent the defenders knowing their positions, and if it is known that the enemy have destroyed any, another line can easily be dropped outside the first.

If mechanical mines could be dropped outside all the enemy's harbours without his knowledge, they would probably prove very effective, and should be tried in any future war, as at worst it would delay the enemy's ships whilst a passage was being cleared, and our ships are not nearly numerous enough to blockade many of an enemy's harbours.

The fleet would probably be divided into two squadrons, an inshore and outside squadron. The inshore squadron being composed of fast cruisers, they would act as the scouts of the ironclads, and should be stationed outside the mouth of the harbour, and outside the range of their guns, so as to form a cordon of ships across the mouth, but if there were not many, or it was a very broad mouth, they would have to steam slowly across, otherwise they might remain stationary, at intervals near enough to prevent any ship passing out unobserved.

They should show no lights at night, and have some distinguishing mark to prevent them being mistaken for the enemy.

The outside squadron should be composed of ironclads, and should be kept more together, to be ready at any moment to attack the enemy's fleet, in case it should attempt to come out. They might steam slowly across the entrance at night, at some distance to seaward, but within signalling distance of the inshore squadron, who should signal to tell them of any ship coming out of the harbour, the outside squadron indicating their position if necessary.

The torpedo-boats and torpedo-catchers would steam about inside the inshore squadron, and would be on the look-out to prevent the enemy's torpedo-boats coming out to attack the inshore squadron; some might be sent to patrol the entrances of any harbours which are close at hand, so as to prevent torpedo-boats being sent out to attack the fleet.

They should signal by firing rockets or some other preconcerted signal, when they observe any of the enemy's torpedo-boats approaching. The torpedo-boats should always be given a new password every night, and great care should be taken to prevent the enemy's torpedo-boats passing themselves off as friends; this will be a great danger in any future war.

If any of the defender's ships try to escape, the nearest fast cruiser should at once proceed in chase, and if it is an ironclad, she should at once signal for an ironclad from the outside squadron, or better still a fast torpedo-ram like the "Polyphemus," if there are any available.

Attack of Ships at Anchor by Torpedo-boats.—The great thing in all torpedo-boat attack, is to use plenty of fast boats and that they should be well drilled at keeping station, or reaching the enemy's ship simultaneously.

Before making any attack it is advisable to know as much as possible about how the enemy's ships are defended and if there are any defences arranged for the harbour, such as a boom or boat mines, also if the ship is provided with the electric light, if so, everything must be painted black in the boats, and also the boats themselves.

If there is a boom across the entrance of the harbour, it is no use sending torpedo or picket-boats in to attack the ships until it is destroyed, and as it cannot be destroyed without exploding a charge, which would alarm the fleet, it would be useless to send the boats in immediately after the boom was destroyed, and the boom would be repaired before the next night.

If boat mines are supposed to be used, boats should be warned to

keep clear of any floating objects, and no doubt if efficiently fitted and placed they would prove very dangerous to attacking boats.

If the ships were known to be defended by wire torpedo-nets, it would be of very little use to send boats armed with Whitehead torpedoes against the ship, except on the off chance of one of these torpedoes penetrating the net, or its possible explosion on striking the net, damaging a ship.

So in this case we have to look round for some arrangement to fire a charge inside the net, and between it and the ship's side. An outrigger torpedo on this principle is being tried on board the "Vernon," and all boats should be fitted with an outrigger torpedo, on this or a similar principle, instead of the present Service outrigger fittings; besides boats should only carry one spar instead of two, so if required they may carry Whitehead torpedoes as well.

These are about the only boats that could be used in attacking ships defended with nets. If there is a boom as well, steam pinnaces can only be used with the false cutwater shipped on the stem.

If the attack is at all feasible, all the steam pinnaces, &c., belonging to the fleet should be used so as to have at least four for each large ship in the defending squadron if they are only three, or if more, three boats for each ship only would be required. The attack should be concentrated on the two handiest ships, as if it is split up too much, most probably no damage will be done to the fleet.

The boats should go in in two lines, the rear boats being armed with their machine-guns as well, to drive off the guard boats if necessary.

They should be well practised in keeping station, and should go in slowly so as to prevent being discovered, show no sparks from their funnels, and if possible keep under the shadow of any high land. When getting close to the boom they must go full speed at it, and after jumping it go on straight for the doomed ships, run at the nets end-on and drop their spar and torpedo over them, fire their torpedoes, and go full speed astern and make their escape as soon as possible. If the ships are using their electric light and throwing the beam about in different directions, after jumping the boom they should spread out; but if the ships are surrounded by a beam of light, some of the boats should be specially told off to attack the vessel or vessels burning the light, and if they succeed in destroying her, they might get a chance of attacking the other ships more easily.

But a fleet thoroughly well defended first by a boom with boat mines outside it, and coir hawsers, &c., to foul the boats' propellers—the boom probably lighted up by a beam of light, and a heavy machine-gun fire laid for the boom—besides all the ships defended with nets, is by no means an easy task and requires a considerable sacrifice of boats and lives, which may not be always sufficiently repaid by the results obtained. If, however, there is no boom or the ships are not defended by nets, the torpedo-boats would have much the best of it; no doubt the nets are the most efficient protection a ship can have at present, and every ship should be supplied with them. If there were no boom, torpedo-boats could be used, but if the ships are known to

be defended by nets, with their Whitehead torpedoes they cannot do much good, without an unsinkable gunboat could be used to ram the defences and carry them away, after which the torpedo-boats would be useful. They would make excellent boats for the outrigger torpedo for dropping over the nets, on account of their great speed, as compared with steam pinnaces, which are only fitted with the outrigger.

But the torpedo-boats, &c., could be sent about to make false attacks and to harass the defenders.

Where torpedo-boats will really prove themselves of use will be in the attack of ships off the entrance of a harbour.

The defenders could make excellent use of their boats in this way, going out and trying to take some of the ships of the blockading fleet unawares, and if discovered too soon, they need not force their attack, without they wish it; they would prove most harassing to the blockading fleet, who would have to trust to their machine-guns and their electric light, without they had their nets very well fitted, and able to get them clear of the water very quickly in case they had to chase a ship; this no doubt will be obtained very soon, but in rough weather it is doubtful if any net defence will ever be arranged so that it will stand the ship rolling about much.

Therefore on rough nights these attacks should be made, and if it were too rough to fire a Whitehead, outrigger boats might be used. The torpedo-boats should go out in two lines, steaming slowly, and trying in every way not to be discovered too soon; but directly they are found out by a ship, to steam straight at her at full speed. The ship if she had no nets out, or could not keep them in place, would no doubt adopt her best mode of defence, that is, to make a running fight, thus keeping the boats longer under fire, in the hopes of destroying them. If she had nets out, she could steam slowly, or better perhaps remain stationary, turning if necessary to bring her guns to bear on any of the boats.

These torpedo-boat attacks would be an excellent way of driving the inshore blockading squadron away, particularly if any ship wished to run through the blockading fleet; they will besides all help to make blockading an enemy's harbour more difficult.

This brings the chapter to a close. As we have discussed the defence of ships at anchor in the next chapter, we will not repeat it in this chapter.

CHAPTER IV.—*Attack and Defence of Harbours.*

This chapter may be divided into two parts. We will first consider the defence of our own harbours and next the attack of an enemy's harbour.

Now owing to the changes brought about by the introduction of steam, and lately by fast torpedo-boats, any night after the declaration of war with a naval Power, we may expect to find some of the enemy's torpedo-boats trying to enter some of our many harbours, and if not prevented, going round destroying the shipping in the harbour; or

there is a chance of some of the enemy's cruisers appearing off our numerous seaside towns, and levying a large sum of money under threat of bombardment. These are two of the kind of dangers our seaports are exposed to which have to be guarded against, and the question which has of late been much before the public is how to prevent these occurrences; this we will now consider.

Our seaports are divided into two kinds, viz., military and commercial ports.

The military ports are such ports as are considered of sufficient strategical importance to defend and make as secure as possible; there are nine of these ports, viz., Portsmouth, Plymouth, Portland, Pembroke, Sheerness, Chatham, Dover, Harwich, and Cork.

These ports are defended by forts, and have a complete submarine mine defence arranged, and are supposed to have the men and material to lay them down; but, however, as no torpedo-boats or gunboats are actually told off for their defence, but as five of these ports have dockyards, there would probably be some ships in the harbour in case of an attack; the other four, however, are without any vessels at all.

It would seem desirable that each of our military ports should have a certain number of torpedo-boats told off for the defence of the port and surroundings only, and not on any account to be allowed to be taken away very far from the port. We would recommend that Portsmouth and Plymouth should each have five boats, and each of the other ports have three boats, which would require thirty-one torpedo-boats for our military ports, and which would add considerably to their defence. Gunboats are not so necessary for these ports, particularly if they are well defended by forts.

The forts for these places are nearly all complete, but many of the guns have never been fired in position, generally because they point towards the town, or some houses; therefore, when these guns may be required to be fired in actual warfare no doubt defects will show themselves, perhaps sufficient to disable the guns during a critical period, as was clearly shown at the bombardment of Alexandria, where many of the guns were disabled through defects of mounting. It would seem advisable that some practical tests should be tried, and perhaps in many places they could be fired with case shot, the guns being well depressed, so as to prevent any chance of the bullets doing any damage; this, if it were done once a year, would be a fairly satisfactory test of the fittings, &c.

The submarine mine defence should be of a kind that it can be quickly laid, easily kept in order, be in such a position as to be well defended by the guns of the fort, and not interfere more than necessary with the navigation of the port.

A defence to be quickly laid should be very simple, and the men should be drilled to lay it down against time. Now it is a matter of doubt to many whether the system adopted by the Royal Engineers answers these conditions: it is, first of all, very complicated, and having relays, &c., in the mines, which alone take time to adjust, it is very questionable whether it can be laid down quick enough for our

requirements; so much so that the Naval Torpedo School used to use relays, but have given them up, principally on account of their being complicated, and we adopt a much simpler system, not having any relay in the mine which is very liable to get out of order; even some Officers consider our system now is hardly quick enough to manipulate, and would adopt only the most simple mines, viz., mines fired by observation. The Royal Engineers are very much handicapped as regards the number of men, only having a few men at each place, but the Militia are supposed to help them, and we believe the Navy also if possible. It always appears rather inconsistent leaving the submarine defence of our ports to the Army, as it is so particularly a seaman's business, that one wonders why the Navy have not charge of the submarine mine defences.

Nearly all of the European nations leave the torpedo defences to their navies.

The Germans have arranged a very perfect system of closing their harbours; they use electro-mechanical mines, which would not be suitable for our harbours, as they close their harbours completely except a narrow passage; but they can lay all their mines in less than twenty-four hours, which is a great deal quicker than we can defend our harbours.

Some of our military ports might have a boom across the entrance, particularly at night, and should have an electric light placed close to it, in order that the beam might be thrown along the boom; this would no doubt prevent a great number of night attacks with boats, which otherwise would be possible, because torpedo-boats are unable to jump a boom, so that steam pinnaces and launches only could be used; and if the light were well placed, it would be difficult to place a charge on the boom in order to destroy it, if any boat failed to jump the boom, it would be certain destruction.

We next come to the second class of ports, viz., the commercial ports, which till quite recently were totally undefended, and no one appeared to mind whether they were defended or not; but thanks to our neighbours on the opposite side of the Channel writing numerous articles in their papers "about how, if they were at war with us, they would send cruisers to extort money, under threat of bombardment, from many of our unprotected seaports," and the late war scare have removed this apathy for a time, and now some of our large seaport towns are willing to subscribe money, and raise volunteers for their own defence, and the Government has held out promises of a certain amount of help, and are going to supply mines for the defences of the Mersey, the Clyde, the Severn, the Tyne, and have allowed the usual capitation grant, &c., for a company of engineer volunteers at each of these places, and perhaps, if these are successful, the number of places will be increased. At present the Government have not promised to provide torpedo-boats for any places; but it seems to us that another danger has not been thought of, which these boats would be able to prevent, that is, the danger of an invasion, and if it can be shown that they are necessary to prevent an invasion of this country, it would certainly be one of the duties of the Government to provide them.

Most Englishmen hardly give the idea of an invasion a second thought unless there is a scare, which seem to recur at different times, but at the present time, since the introduction of steam and the increase in all the foreign navies, while ours has been allowed to remain about the same, so much so that many persons consider the French Navy nearly equal to our own, it becomes a matter of importance to take some means to prevent the possibility of an invasion. When even in the days of sailing ships Napoleon only wanted command of the Channel for one day—and he said he would be in London on the fifth day—less would now be required in these days of steam.

We recommend torpedo-boats as a very cheap and effective way of protecting a long coast line; and they will also help partly in the defence of our commercial ports. Perhaps we might draw a rough imaginary picture of an invasion to explain the use of torpedo-boats. We will suppose an enemy, say the French, have been preparing for an invasion for some time and have concentrated their fleet, a number of transports, troop-boats, barges, and every conceivable craft that is able to be towed across the Channel on a fairly fine day—the French fleet having either inflicted a severe defeat on our fleet, or attracted them away—the transports and the ships left behind to convoy them would at present find nothing to oppose them until they attempted to land. We will not discuss whether they would be able to land, which is a military question, and depends very much on the number of troops we are able to concentrate on any part of the coast in a certain time. Now the duty for the ships or torpedo-boats (if there are any) for the coast defence, is to harass and destroy the transports before the troops have time to land; this duty torpedo-boats ought to do very well, as directly the fleet was sighted off our coast, the coast-guard look-out should telegraph to the nearest ports for torpedo-boats, these boats should always be kept in readiness, and would be able to start off nearly at once, and ought soon to reach the place of disembarkation, where, if they did their duty, before the troops would be able to effect a landing several of the transports ought to be at the bottom; the transports' only means of defence being the ironclads. These would find it very difficult to defend a large fleet of transports against a torpedo-boat attack, besides, the fire of the ironclads would be required to drive away the opposing force, and the transports would mask their fire to a great extent, without they were anchored rather carefully.

For this reason we think that torpedo-boats are much wanted, and should be supplied by the Government, coast defence gun-vessels would be also very useful to support them; these would also be useful for some of the commercial ports.

We next come to consider what system of defence the Government might be expected to provide, and what should be left to the seaport towns to pay for. A certain number of boats and *matériel* should be provided for each place according to its size and importance by the Government, and the men should be raised in the seaport towns to man them, and be incorporated as volunteers receiving the usual capitation grant, and if any place does not consider it has sufficient

defence they should be allowed to subscribe for more boats; but at the same time they would have to enlist more volunteers to man them, and should be expected to maintain the boats in repair.

The next thing we have to think about is how many boats each place should have, and whether some places could not be defended with forts and a submarine mine defence, or gun-vessels and a mine defence, or whether many of the tug-boats and launches could not have fittings put into them in time of war (which should be kept in store in the port), so as to be able to use the boat either for the Whitehead or spar torpedo.

We should recommend that each port should have a certain number of fast torpedo-boats and fittings for small tug-boats, varying according to the size and importance of the place. Also that certain important ports besides should have a gun-vessel stationed, specially for the defence of the port, and other more important ports should have a submarine mine defence, protected by shore batteries if possible, or otherwise by one or two gun-vessels.

The following table (p. 409) is drawn out to show the least number of gun and torpedo-boats that are required for the defence of each place, and which ports should have a submarine mine defence as well.

The following smaller ports also require torpedo-boats, and should have one boat stationed at each port, viz.:—

Yarmouth, Lowestoft, the Tay, Aberdeen, Wick, Thurso, Ramsgate, Rye, Littlehampton, Poole, Dartmouth, Wexford, Waterford, Kinsale, and Galway.

Some of these ports which own tug-boats might have outrigger fittings supplied for them.

We have allowed for the five most important places to be defended by submarine mines, these places should have shore batteries as well. We should recommend that the submarine mine defence should be as scattered as possible; these places being a few miles inland, it might easily be managed—one defence near the mouth of the river, another a little way further up, and so on according to the amount of material and men available; the main defence need only be commanded by batteries, the others might be more or less protected by boats. The navigation of the port must be in no way interfered with, therefore observation mines are the best to use, and as they do not require any internal mechanism which is liable to get out of order, they are doubly suitable. We would recommend them to be fired in lines of three mines, one observing and firing station combined being used for each defence if it does not consist of more than three or four lines, and of more than two stations. The rivers being narrow, a ship could hardly be able to get past the lines without being observed, but during foggy weather, as an additional precaution, a steam-launch might be told off to patrol outside the lines, and could give timely warning of an enemy's approach by signalling with her steam-whistle, or if a stationary boat were used, it could be joined to the shore with a wire and telephone, &c., or another method which might be adopted in foggy weather, is to stretch a coir hawser across the entrance (when it is not very broad), one end being brought close to the firing station,

The Population, Commerce, and Tonnage of Ships is taken from Sir Charles Nugent's Lecture in 1885 at the Institution.

| United Kingdom. | Population, 35,262,762. | Commerce £694,105,264. | Tonnage, 98,773,156. | Number of torpedo- boats. | Submarine mines. | Coast-defence vessels. | Number of sets of fittings for tug- boats, &c. |
|----------------------|----------------------------|---------------------------|-------------------------|---------------------------------|---|---------------------------|--|
| London..... | 4,766,661 | £198,291,323 | 15,142,223 | 5 1st class. | Yes; to be laid at different parts of the river. | 3 | 6 |
| Liverpool | 552,508 | 195,863,002 | 13,258,076 | 4 " | Yes. | 2 | 6 |
| The Humber | 111,549 | 53,935,573 | 4,695,479 | 3 " | No. | 1 | 3 |
| The Clyde..... | 586,431 | 29,854,134 | 6,033,116 | 4 " | Yes. | 2 | 6 |
| Southampton | 60,051 | 16,845,806 | 2,168,296 | Defended | by its proximity to Ports mouth. | | |
| The Forth..... | 275,287 | 14,367,809 | 2,364,237 | 3 1st class. | No. | 2 | 3 |
| The Tyne Ports | 121,476 | 11,197,542 | 7,573,010 | 3 " | Yes. | 1 | 3 |
| The Tees..... | 206,874 | 9,863,673 | 2,561,808 | 3 " | No. | 1 | 3 |
| Bristol..... | 82,761 | 9,128,550 | 1,695,877 | 2 " | Yes. | } | { |
| Cardiff..... | 65,597 | 6,102,493 | 5,046,709 | 2 " | No. | | |
| Swansea | 273,064 | 3,087,361 | 1,701,244 | 2 " | " | 2 | 3 |
| Dublin..... | 207,671 | 3,072,361 | 2,840,326 | 3 " | Yes. | 2 | 3 |
| Belfast | 116,542 | 2,752,505 | 3,000,740 | 3 " | No. | 2 | 3 |
| Sunderland..... | .. | 1,274,111 | 2,750,857 | 3 " | " | 1 | 3 |
| Folkestone | .. | 11,539,621 | 396,793 | 1 " | " | .. | 3 |
| Newhaven..... | .. | 9,355,164 | 354,426 | 1 " | " | .. | 3 |
| | | | Total | 42 " | 6 places defended by mines. | 19 vessels. | 52 sets of fittings. |

and if any great strain is brought on the hawser, or if the hawser parts, it is certain that a ship is running past; and if the hawser be laid just in advance of the outer line, all that has to be done is to fire the line when this occurs.

Another method is to lay one or two lines of dormant mines in advance of the other mines, and during foggy weather to blow them up close to the surface, then if any ship bumps them, she will be blown up; this method necessitates (at present) the mines to be weighed and relaid again after each fog, which is a great disadvantage; besides if resorted to only, observation mines are wasted during foggy weather.

The gun-vessels we should recommend are those we recommended in Chapter II for coast defence, as they would be able to go outside in rough weather and carry a heavy gun, though the present type of gunboat, like the "Bloodhound," will do for some places where, to prevent the town being bombarded, it would not be necessary to go outside, as they are bad sea-boats.

The torpedo-boats should be the best that can be obtained, handy in turning, and not larger than the "Childers" type (113 feet long), although in some places with narrow entrances, &c., wooden torpedo-boats would answer better; but they are hardly good enough boats for defending the coast, whereas the "Childers" type are very good sea-boats, therefore, if available, they should be used.

The fittings for the boats should be principally for outrigger torpedoes, and if there are enough Whitehead torpedoes available, a certain number of sets of dropping gear might be sent to the principal ports, but on the whole we would recommend the outrigger for these tug-boats, as the men would want comparatively little training.

This idea has never yet been tried, but seems well worth trying, considering the large number of tugs, &c., available at our seaports, and it is important that during peace-time it should be practically tried, by fitting one or two typical boats with the gear, and trying whether they are able to stand the explosion of the charge, &c.

We next come to the training of the men, and what kind of men we should encourage to volunteer to man the boats.

First.—Each place should raise the number of men required to man the boats allotted to it.

Second.—They should all be seafaring men if possible, and should be entirely under the Navy. A Captain in the Navy and one or two Torpedo-Lieutenants should be appointed to organize and superintend the different corps.

A certain number of men might be sent to the "Vernon" every year to be trained for their particular work, receiving the same allowances as volunteers do when in camp.

The men intended for the outrigger boats should learn only how to use the outrigger, and be able to fit and fire the charge with safety—for which a fifteen days' course would be sufficient, and allow time for a good amount of time to be devoted to making dummy attacks singly, and in company with other boats.

The men intended for the Whitehead boats should have a longer course of thirty days (if possible), part of the time being devoted to instruction in handling the boats.

The artificers, who would be required to take charge of the torpedoes, would require a longer course, besides learning how to work the engines of a torpedo-boat.

The stokers should if possible be sent for a course in working the boats, so that when the boats arrive at the different ports, the crews will have all been trained in their particular work.

We have not yet mentioned the Officers; there ought not to be any difficulty in obtaining any number of gentlemen who are fond of yachting, to volunteer to take charge of the boats, or if possible retired naval or merchant service Officers might be obtained, which would be of course better. The Officers would require the same length of course as the men, except those intended for the Whitehead boats, who ought to be thoroughly acquainted with the particular pattern of torpedo they are going to be provided with; if possible, each place should have torpedoes of the same pattern; this is every day becoming more important on account of the many different kinds of torpedoes which are being made.

There ought at least to be one spare crew for every three boats, to form a relief crew and to fill up casualties, as every night at least one boat would be required for patrolling; this will prove very arduous work during our next war.

The men and Officers should be exercised in the torpedo-boats at certain fixed times during the year, and the crews for the outrigger boats should also be drilled, but special arrangements would have to be made about the latter crews, as they would only have their boats fitted during war-time, as a harbour service steam pinnace might be lent to each port for drill purposes.

These crews might be enrolled in a corps similar to the Naval Artillery Volunteers, only with more branches, and might appropriately be called the Naval Torpedo Volunteers.

The crews for the gunboats would be drawn from the Naval Artillery Volunteers, extra branches having to be formed at the places where none exist at present, the men being trained on board the "Excellent."

The men for the submarine mine defence are being enlisted at four of the principal places, and will be under the Royal Engineers, which seems open to the same objections as we mentioned before.

Defence of Coaling Stations.

The defence of our coaling stations is our next consideration. Money is being voted for the erection of shore batteries at these vulnerable and important points, but at present no coast defence vessels or torpedo-boats are stationed at any of these places, except Malta, Gibraltar, Hong Kong, and the Cape, but their numbers even at these places are not sufficient.

Four first class torpedo-boats at least are absolutely necessary at

most of the coaling stations and one or two coast defence gun-vessels, besides a complete submarine mine defence.

Everyone owns that the coaling stations are of great strategic value and should on no account be allowed to fall into an enemy's hands; an enemy should not be allowed even to approach near enough to be able to shell the coal stores. One can easily imagine the position of a fleet with hardly any coal left, making for one of the coaling stations to replenish and finding it either in the enemy's hands, or that the enemy had set the coal stores on fire. Besides the loss of a coaling station would give the enemy's cruisers a safe haven to start from and prey on our commerce, as they are generally situated close to the principal lines of traffic. The men to man the boats might at some of the stations be volunteers, raised in the place, but at others blue-jackets would have to be sent out from England.

Besides the harbours mentioned above, there are others where a fleet or single ship might have to take refuge in the face of a superior force, which it would be imperative to defend.

If the ship or fleet were closely followed by the enemy, one of the quickest ways to block the entrance is to drop electro-mechanical mines across the entrance of the harbour; these, with the automatic depth adjusting arrangement invented by Lieutenant Ottley, could be dropped by the ships as they enter the harbour, and would take up their proper depth, without any necessity of soundings being taken.

But if the ships were not very closely followed by the enemy, it would be preferable to lay out electrical mines, and defend them by the guns of the ship. To enable this to be carried out, the ship or ships should be anchored opposite the entrance, and should either have a spring on their cables, or be moored head and stern, so as to have their broadsides bearing on the mine field.

If only one ship is seeking refuge, at present during war-time she will be provided with twelve observation mines and six E.C. mines, which would not make a very good defence; but we hope that more E.C. mines will in future be carried by our large ships; with casks more E.C. mines might be extemporised.

The mines would be laid across the entrance, the observation mines being laid in the deepest channel, and near where the firing and converging station is intended to be, the E.C. mines being laid in the other part of the channel.

The cables should be brought into the firing station, which should be erected in a place which is easy to defend, and should also be used for converging the lines of observation mines on. The field guns and a certain number of men should be landed to defend the station.

A boom might be made to defend the entrance if there is time, but it is by no means a necessity.

The ship should be well defended by nets if securely moored, might be surrounded by boat mines, and coir hawsers might be stretched round the ship as well, in order to foul the screws of steam-boats.

If time permits, dummy cables should be laid in advance of the real cables, to prevent them being destroyed.

Guard-boats should be used, but on no account allowed to approach within a certain distance of the ship, and not allowed to come alongside on any account after dark. They might fly white ensigns to distinguish them from the enemy's boats.

If a fleet had taken refuge, a more elaborate defence might be devised; the firing station taken more to the rear and a separate converging station should be used. The torpedo depôt ship would prove most valuable, and would be able to supply the extra cable and gear required.

We would not recommend mechanical or electro-mechanical mines being used for the defence of the entrance; but in case there were two entrances, one could be very easily completely blocked with these mines, which would not want so much trouble being taken to defend them, besides being much quicker laid.

The main entrance should be defended with observation and E.C. mines, and each entrance should have one or two lines of boat mines laid across the entrance.

The defence of the mine field might be left to the boats of the fleet, as an ironclad or gunboat anchored near the mouth of the harbour would be very liable to be attacked; the boats would, however, have to be very careful not to cross the line of boat mines. If there are any positions on shore near the mouth of the harbour, it might be worth while to land some of the field-guns from the fleet, leaving the others to be landed to defend the firing station.

A boom might be laid across the entrance if time permits; if so, the boat mines should be laid just in advance of it, and whenever a boom is made, it is advisable to make it double, as it is more likely to be effective in stopping boats, the booms being placed about 30 feet apart.

The next thing we have to consider is how we are to anchor the fleet, in order that the ships can best resist a torpedo-boat attack.

Opinions differ on this important point, and it seems that we have hardly tested any of the various methods, as very often when a torpedo attack is arranged, the positions of the ships are not altered, and as they are anchored as usual in peace-time, no method is tried of how to anchor the fleet to the best advantage.

Very often six or eight boats are sent away to attack a fleet of perhaps seven or eight ironclads, and many Officers seem often surprised that the boats do not succeed in destroying one or more of the ships; this, of course, gives a false impression of the danger of a torpedo attack, and one is led to believe they are not as dangerous as they really are; but the real question is, would any Admiral during war-time ever think of sending six or eight boats to attack a fleet of ironclads? Of course if he really intended to make an attack, he would not think of sending such a small number in, and would wait until he got a larger number together, although he might harass the enemy considerably with these few boats.

We would recommend our ships to be anchored as close as possible together, and to form themselves either into two lines or a square, as shown in the diagrams (IX, X), according to the number of ships,

the line of bearing to anchor on being the direction of the prevailing wind; when the ships are anchored, they might before dark each night, run out a wire hawser from the stern of one ship to the bow of the next, and have the wire sufficiently taut and low down so as to catch the upper part of the stern, or the funnel of any boat trying to pass between the ships. This, if not expected, would disorganize a boat's crew for the time, and if guard boats were on the alert just inside the hawsers, they ought to succeed in capturing the torpedo-boats that try to pass between the ships.

We have shown also in the diagrams how the electric light should be used.

It has been found in different attacks that indiscriminate use of the electric light is worse than useless, so we recommend that the fleet should be surrounded by a beam of light, which would require four projectors. These might either be obtained by using two ironclads or four gunboats; we would strongly recommend the four gunboats, as they are much more difficult to destroy, as they offer a much smaller target and do not draw so much water, and can be easily defended with nets, and, if considered necessary, with a row of boat mines round them. If these are used they should be moored head and stern, although, if possible, they should be moored head and stern either way, as this will prevent any torpedo being dragged under their bottom. These gunboats should be anchored in *échelon*, so as to bring all their guns into play, and should be completely surrounded with nets. In some harbours where there is only one narrow entrance, a gunboat or even two gunboats anchored near the mouth and close inshore could throw a beam of light across the mouth, and some of the ships could be anchored fairly close so as to bring their guns to bear on the beam. If this were efficiently done, there would not be so much necessity for this complicated method of anchoring; but this method or some similar one would be necessary in an open roadstead, or in a large harbour with several entrances.

Diagram IX represents a fleet of six ships, surrounded by the beams of four electric lights, which are burnt in four gunboats, the ships being protected as before described, the dotted lines showing the wire hawsers between the ships. If the wind changes the wire hawsers would have to be eased, or perhaps let go and dipped, if the ships turn right round. We have placed the ships at a cable apart and the lines at $1\frac{1}{2}$ cables apart, but if it would be considered safe, would like them even closer.

Diagram X represents a fleet of sixteen ships, anchored in a similar formation to the preceding diagram.

If there were transports, they could be anchored in the centre. Those gunboats burning the lights would be required if there were more ships, and they would have to be placed half way along the sides as at A; but experiments are very much wanted to find out the length of beam that could be used for a defence similar to the above. We should think 2,000 yards is perhaps as long as can efficiently be used.

In either of these cases a boat to fire a Whitehead torpedo would have to pass through the beam of light, and if the guns were laid

just inside the beam, they ought to be hit before having time to fire a Whitehead; and in view of the latest improvement in using an outrigger torpedo against ships defended with nets, any outrigger boat ought to be rendered *hors de combat* before getting near the ship's nets. If the nets are properly placed round the ships, even if a Whitehead torpedo be fired, it will not seriously hurt a ship, and in fact ought only to shake the ship if the net fires the torpedo. It is very necessary that the nets should be well laced together, as if the lacings are only carelessly passed, there are a great many chances in favour of the Whitehead.

The Navy is besides supposed to defend all harbours which the Royal Engineers do not defend; they, as we mentioned before, defend our military ports, coaling stations, and a few of our principal commercial ports, or we might be called to defend any newly acquired harbour, such as Port Hamilton, which was defended by the China squadron during the Russian scare.

A defence similar to the above can always be arranged, and has been practically tried several times at Bantry Bay, and laid very quickly indeed, the principal part of the defence being laid in thirty-six hours from the time of the fleet anchoring.

The Attack of Harbours.

We next come to the second part of this chapter, viz., "the attack of harbours."

This we all hope and expect will be the principal part of our work in any future war, and that having defended our harbours as a precaution against any emergencies, we shall be principally engaged in attacking the enemy's harbours.

There are certain fundamental rules we are bound to observe when planning the attacking of an enemy's harbour, which the introduction of submarine mines has made necessary. Thus, during the American civil war, wooden ships were able to run past batteries that were armed with very heavy guns, but directly submarine mines were placed across the channel and under the fire of the guns of the forts, this was very considerably modified, as before the wooden ships could advance, they had first to clear the channel, which occupied a certain time, during which they were under the fire of the fort, and thus rendered their passage very often impossible, and always with some considerable loss.

Most of the advantages gained by the Federals were gained before the Confederates used mines.

The first rule is that if the place is known to be defended with mines—

A systematic attack on their mine field must be made, so as to clear a passage broad enough for the ships to move up and bombard the forts.

Secondly. That the ships must be powerful and numerous enough, when there, to be able to silence the guns of the fort.

Thirdly. The ships should be protected with torpedo nets, and

might have a torpedo dredge fixed ahead, projecting sufficiently far to prevent the ship being hurt by any mine it fires.

Fourthly. When the attack once begins, it should be carried on without intermission until the channel is cleared and the forts are silenced, and great care should be taken to prevent the enemy dropping mechanical mines in that part of the channel which has been cleared.

There are four different operations which would probably have to be done in order to clear a long channel, viz.: 1, Sweeping; 2, Slow creeping; 3, Rapid creeping; 4, Countermining.

But before commencing an attack it is advisable to study the chart well, and procure spies if possible, to find out where to expect to find the enemy's mines.

If the water gets deep very quickly, it may safely be assumed that there are no mines very far from the shore, and as the forts will most probably be situated at the entrance of the harbour, electrical mines will only be used, so sweeping will not be required.

If the water gets deep very gradually, the mines may extend some distance to seaward, and as electrical mines are not laid outside the range of guns, mechanical mines will only be found some distance from the shore, therefore sweeping will first have to be done.

The fleet should anchor some distance from the shore, outside where the mines are supposed to be laid, and get their nets out.

Prepare their pulling boats for sweeping.

Mark the channel to be cleared with small buoys, send the boats in by pairs, to sweep a certain length of the channel and go over the same ground in opposite directions, and when they are thoroughly satisfied that it is clear of all mines, the boats to thoroughly sweep another length of the channel, until it is supposed they may have reached the neighbourhood of the electrical mines, when the process of slow creeping will begin. This, as well as sweeping, should be done at night, except when the sweeping is carried out well out of range of the enemy's guns, but in either case the sweeping boats should be supported by some armed steamboats, which should keep in rear until wanted.

Sweeping should not be carried out at low water if possible.

The idea of slow creeping is to pick up the enemy's cables, having first of all broken the continuity of the core, and underrun the cable to see if it leads to a multiple cable, and if it does, to cut the multiple cable, thus rendering all the mines attached to it useless.

This can only be carried out when not under fire, or when the enemy more or less permits it, so that probably slow creeping will not be able to be carried out, and instead, rapid creeping will have to be done. The great thing is to have plenty of boats fitted to carry the creeps, and steamboats to tow them; when all is ready, move the ships up (if not previously done), engage the forts, and under cover of the guns send the creeping boats away to creep the remaining part of the channel, the boats to work in opposite directions, so as to avoid the dummy cables; if possible, send some boats in along the shore where the firing stations are supposed to be.

When this part of the channel has been well crept over, the counter-mine launches should be ready to lay the countermines. And then again, under cover of the fire of the fleet or at night, first assuming that the fleet are getting the best of the forts and will be able to move up and occupy the channel cleared, run the first two lines of countermines; when run, fire them immediately, and in half an hour's time the fleet should move up and occupy the channel cleared; then other two lines should be run, and so on, until the channel is cleared. If a broader channel be required, creeping boats can go on creeping on the sides of the main channel cleared. If there is a boom across the entrance, it would be first of all advisable to run a line of countermines over it, and then it can be best discharged by sending one of the ships to ram it, which is certain to destroy any boom that can be made.

We have now roughly described how to destroy the submarine mines which may be laid by the enemy; these being destroyed, the bombardment of the forts is very much the same as it was some years ago, except being easier since the introduction of steam. If it be intended to occupy the forts, &c., soldiers will most probably be required to help the landing party from the fleet.

We have not yet mentioned how to move the ships up to engage the forts.

After the sweeping boats have cleared part of the channel, one of the ships might move up and anchor at the end of the cleared part of the channel, and if it is within range of a fort the ship should have good bow fire; then, as more of the channel is cleared, the ships can move up one by one, each one anchoring in front of the last anchored, and after the creeping and countermining has cleared more of the channel, the last ships move up first and occupy the place, anchoring before the first ships, and so on; this saves the necessity of all the fleet weighing each time and moving up.

With a fleet in line ahead like this, as it approaches the forts it brings a very large amount of guns to bear.

If any of the defender's torpedo-boats attack the ships in this position, the ships must trust to their nets, Nordenfelt guns, and should have their own torpedo-boats handy to help to protect them, the cleared part of the channel being so narrow as to prevent them manœuvring to defend themselves.

We have given a brief idea how to destroy the enemy's mine field, which before any future bombardment of the forts belonging to any civilized Power, we shall undoubtedly have to do.

With an enemy always on the alert, and with a good proportion of torpedo-boats, &c., it will be very hazardous work, and will take some time probably to do, without it is considered desirable to run a little risk; but imagine a torpedo exploding under one of our ironclads' bottom, what a great block it will make in the channel! and it seems that a fleet engaging in an attack of this kind should be provided with some appliances for raising the ships that are sunk by mines or torpedoes. Some Officers propose ships should be already slung with chains in case of an accident of this kind, and that the necessary

lighters, &c., should be attached to a fleet as well as a floating dock; this of course will vary very much with the place attacked. The ships would require an extra supply of ammunition before a bombardment, and care should be taken that if the enemy's guns are mounted behind earthworks, there should be plenty of common shell on board the ships.

Having thus discussed the different changes in naval warfare caused by the introduction of the ram, the torpedo, and the submarine mine, we should like, before finishing the essay, to briefly sum up the different points which seem to require more attention.

They are as follows:—

1st. An increase in the age of entry of naval cadets, and a more mathematical and scientific education for the executive branch, without neglecting practical seamanship; thus if more Officers be highly trained, naval Officers will be better able to express an opinion about the construction of our ships and ordnance, which it seems very important they should be able to do.

2nd. The Channel and Reserve Squadrons might meet every year, and practice at mimic warfare on similar lines to that carried out annually by the Russian fleet, where one part of the fleet declares war against the other part for about ten days or a fortnight, and during which time they attack each other in every conceivable way, to represent as near as possible what would happen in actual warfare; if this were carried out every year, even more experience would be gained than during the annual torpedo operations at Bantry Bay.

3rd. Experiments might be carried out to prove whether a ship's bow wave will actually deflect a Whitehead torpedo, as was supposed to be the case with one of the torpedoes fired at the "Polyphemus."

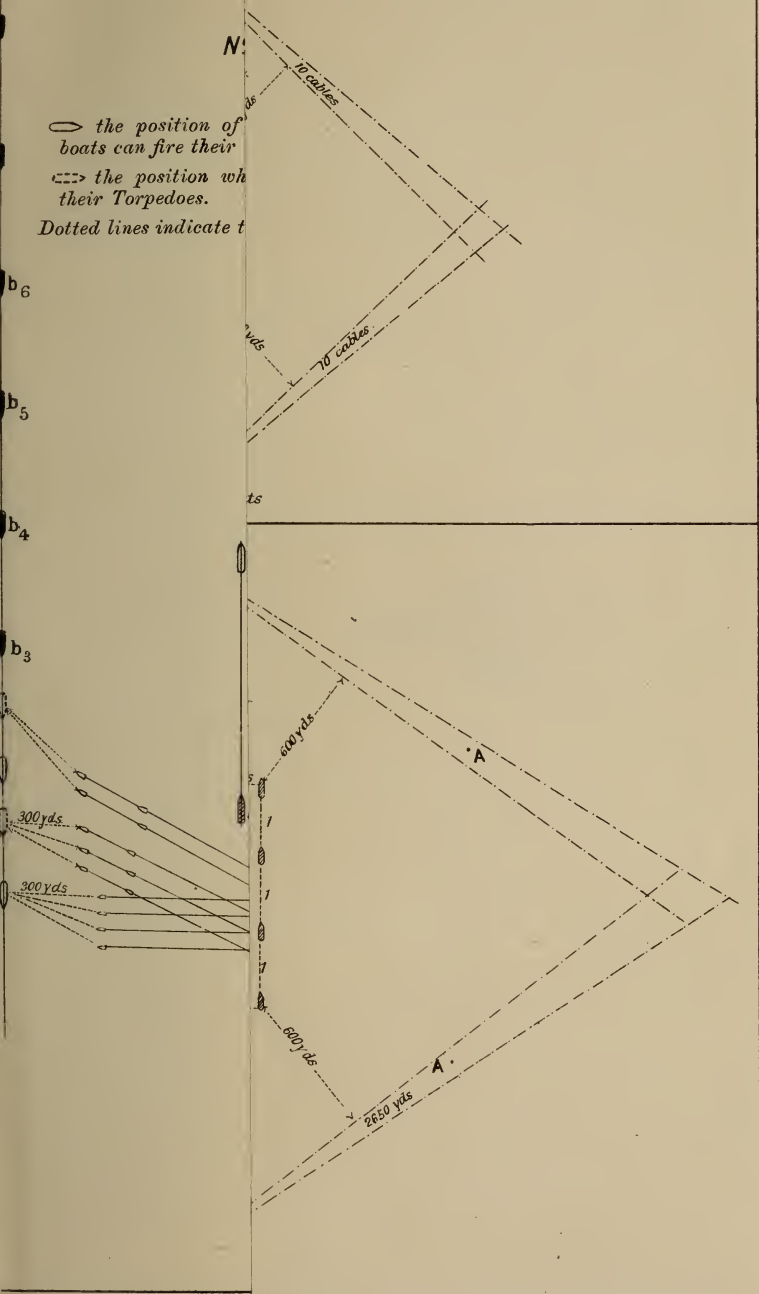
4th. It seems very important that experiments should be carried out to find out the best way to anchor a fleet so as to resist a torpedo-boat attack, and also the best method of using the electric search light for the defence of the fleet.

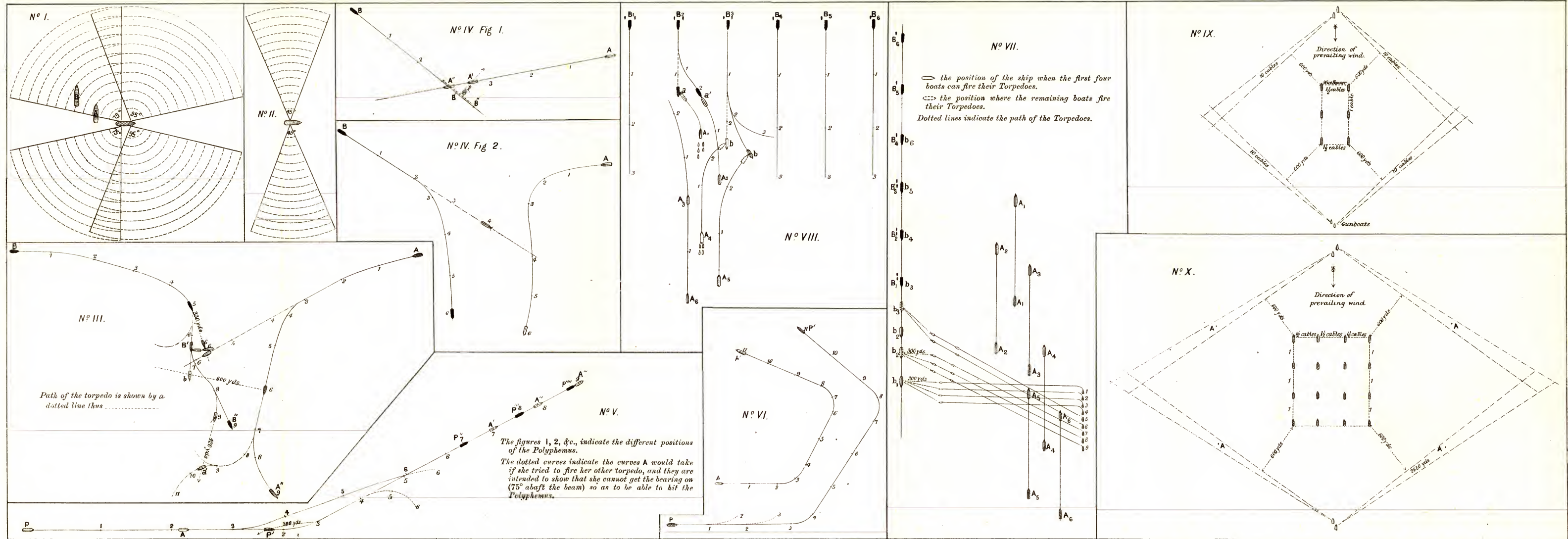
5th. It would also seem advisable that experiments on a larger scale should be carried out with electrically propelled boats, as these boats are particularly suitable for torpedo-boats, on account of their being noiseless, and showing no sparks, &c., and thus would be very difficult to discover.

6th. The defence of our commercial ports by torpedo- and gun-boats, and also the formation of local corps of Naval Torpedo Volunteers for these ports, seem to require immediate consideration.

These appear to be the most important points which press for consideration, although every day some new improvement is being brought out, and we must always be on the watch as to its practical utility for the Service, or whether it will not modify the present conditions of naval warfare. Thus at present the Nordenfelt submarine boat occupies the attention of the European navies, which, if it prove a success, will prove a very cheap and effective method of defending our harbours.

In conclusion, we must apologize if we have stated any views in opposition to those of more experienced Officers.





ESSAY.¹

THE CHANGES IN THE CONDITIONS OF NAVAL WARFARE, OWING TO THE INTRODUCTION OF THE RAM, THE TORPEDO, AND THE SUBMARINE MINE, HAVING REGARD CHIEFLY TO THE FOLLOWING POINTS IN OUR OWN AND FOREIGN NAVIES, VIZ.:—TRAINING OF PERSONNEL; CONSTRUCTION AND PROTECTION OF MATÉRIEL; AND ATTACK AND DEFENCE OF SHIPS AND HARBOURS.

By Captain ROBERT HASTINGS HARRIS, R.N.

“England expects every man to do his duty.”

CHAPTER I.—*The Changed Conditions of Naval Warfare.*

THE subject for an essay as quoted above the text of our present chapter is a large one. What volumes have been both written and spoken, and what controversies have been excited concerning the three separate points to which our attention is more prominently directed, and rightly so, for it is not alone recognized by many in England, but it has been publicly proclaimed by several foreign naval experts, some of whom are entitled to command our greatest respect for the eloquent and vigorous expressions of opinion that they have given us,² if not for the refreshing candour with which they do not hesitate to say that if a nation like ourselves should be unwise enough to ignore the study or neglect the use of those novel weapons which threaten to change and revolutionize the whole system of naval warfare, such a nation must on some future day pay the penalty for her negligence by suffering a serious naval reverse, probably leading to a total collapse of her maritime power.

Coincidentally with the rapid improvement in weapons of destruction, the art of naval war, like the art of military war, is perpetually changing, rapidly, in fact, resolving itself into a new strategy suited to the weapons of its day. It is idle to deny that the nation which has best adapted herself to the changed conditions of her day will be

¹ The length of the essay so far exceeded the limits prescribed by the regulations that it could not be admitted to competition for the medal.

The essays by Commander Kingscote and Captain Dowding, R.N., received honourable mention.—ED.

² *Vide* the French Admiral Aube's "Treatise on Naval Warfare and the Military Ports of France," and others, &c.

most generally victorious in battle. In no epoch of the earth's history has the art of naval war been more radically and distinctly changed than during the past quarter of a century.

It is thus fearfully incumbent on us in Great Britain to see that after due trial we unhesitatingly accept and adapt ourselves to each changed condition, for at no other period has any nation presented a more tempting object to the ambition and cupidity of rival nations than we do at this moment. Our unarmed ships are daily and peacefully traversing the vast seas and oceans of the globe, deeply laden with rich treasure and costly merchandize; our wealthy and populous outlying towns and Colonies are scattered and numerous, and they are mostly unarmed and helpless.

What has protected these in peace and prosperity for the last seventy years? Nothing but our command of the seas and our grand naval *prestige*.

These blessings were obtained by the wisdom, valour, and hardihood of our forefathers, but the battles by which they won them were fought under vastly different conditions from those we shall have to fight to retain them, and they will not much longer be suffered to pass unchallenged. Abundant proof exists that in the naval wars of ancient days the invention of a new weapon or the adoption of an improved system of naval tactics, usually succeeded in transferring the naval supremacy of the day to those who were clever and bold enough to first adventure their practicability.

To us personally it is self-evident that chronic neglect or supineness in regard to naval matters must some day most certainly put it within the power of some other nation to crush the maritime supremacy of Great Britain as surely as Carthage, with all her wealth, was beaten and subdued by the superior vigour of ancient Rome.

We say again, and it cannot be said too often, if the war navy of Great Britain be neglected, and a long-established and parsimonious economy be allowed to impair the fighting efficiency of her war ships, and discourage the well-proved energy and self-reliance of her naval Officers and seamen, then indeed will there be no need for some hostile foreign statesman to make the words of Cato, as he declaimed in the Roman Senate, "*Delenda est Carthago*," applicable to Great Britain, for simultaneously with the fall of her naval supremacy must our glorious and beloved country inevitably cease to be one of the Great Powers of the world. Then will England cease to be the England of our illustrious ancestors; then she must dwindle, possibly step by step and by slow degrees, but nevertheless with absolute certainty, to the same level as Holland, Portugal, or Denmark.

Do not let us ever fall into the error of supposing that our present maritime supremacy is a heaven-born gift, always to be retained by virtue of our insular position, or on account of that grand and not to be undervalued naval *prestige* which has been bequeathed to us by the valour of our forefathers, or because of our great and peculiar naval resources. No; did not the Phœnicians, the Romans, the Greeks of old, and many other nations of later years successively assume, and perhaps at the time with good reason, that they were

for ever to be unrivalled on the seas? vainly believing their maritime supremacy to be permanent. But was it so?

Let us Englishmen endeavour to be wiser in our generation, and profit by the lesson that they teach us, one and all striving to prevent our hitherto almost unquestioned naval superiority from slipping away from us. If we do let it go, shall we ever regain it?

But it may be said, need we have any uneasiness on this score? for surely more interest is taken in naval affairs now than of yore. Look at the daily papers; see the patriotic efforts of some of them; notice how continually Admiral So-and-so writes concerning the necessity of keeping up our naval strength. Most true indeed. But where is the result? Does the great interest in the welfare of their country exhibited by these few patriots permeate the whole nation and lead to effective results? No; it may be truthfully answered that the large majority of Englishmen are in a state of profound ignorance as to the efficiency or inefficiency of their naval resources, and more profoundly ignorant as to the naval resources of other maritime nations. Most true it is, however, that when, as is spasmodically the case, the needs and shortcomings of the Navy are properly brought home to the minds of our voters and their representatives by some scare, or by the near prospect of war, then few will grudge or flinch from spending any money to place their Navy on a proper footing; but, alas! it is equally true that the scare will subside almost as quickly as it arose, and then once more the all-important question that can be well expressed in very few words, viz., the entire safety and welfare of the nation, is again for a time dismissed from the public mind, which will shortly afterwards be for months attentively engrossed with the more burning question of an extension of the franchise, the disestablishment of a Church, a local management Bill, or the relative merits of the Ministry and Opposition.

There is nothing new in all this; it is only history repeating itself again and again; but whereas half a century ago, when all things moved far more slowly than they now do, this summary dismissal of naval questions might have wrought comparatively little harm, and did not, as it now does, jeopardize the very existence of our country. Then our sea-girt isles were almost self-supporting, our population was one-third less than it is now;¹ then our importation of foreign food was practically nil, last year the value imported was 122,824,848*l.*, averaging about 3*l.* 9*s.* per individual, while the totals of our imports and exports reached the enormous yearly sum of 732,228,000*l.*, a large proportion of which is always on the high seas and consequently assailable. What a temptation this must be to our neighbours. Why, the wealth of the Spanish galleons we used to capture and pillage represents in comparison an infinitesimal sum!

In those days we were acknowledged incontestably superior on the high seas; then our unrivalled seamanship was a national safeguard; then our ships were self-containing in all the elements of their efficiency; the steam-engine was in its infancy, the ram was unheard

¹ Population in 1831 was 24,932,495; 1881 was 35,241,482.

of except as a remnant of barbarism, torpedoes or submarine mines were almost unknown, while the naval gunnery of the day was absolutely charming from its very simplicity. What dreamer would then be adventurous enough to say that the fleets of the future would manœuvre at 12 or 14 knots speed, and that they would have entirely discarded the use of sails in action? Had he done so he would have been pronounced well fitted for an asylum. Even quite recently few men were bold enough to think that steam was capable of being used afloat except as an inferior auxiliary to sail power.

In those good old days of our naval pre-eminence there was no need to reckon and compare ship against ship as in these days of modern armourclads; there was then no need to inquire whether the speed of any ship was 11, 16, or even 18 knots; there was no question as to the relative merits of steel, compound, or iron armour; there was no vexed and hotly disputed question as to how this armour was to be distributed. There could be no quarrel as to the merits of revolving turrets or barbette towers; no protection from quick-firing and machine-guns was imperatively demanded. True it is that naval architects were not of one mind as to the form of hull and amount of beam to be given, but no such difficulties as those we have so hastily mentioned had fallen around them.

Go back to those bygone days and name at haphazard any English line-of-battle ship, and she floated, if well found, the unquestioned equal or superior of any foreign vessel; her speed at the most differed only a knot from any possible opponent. Placed on the high seas she feared nothing. She felt no sense of insecurity from the possible approach of a tiny torpedo-boat capable of terminating her existence in a few seconds; she dreaded no ram with a speed far exceeding her own; in fact, barring a heavy gale and a lee shore, or an overwhelming assault from several of her hostile compeers, there was nothing that could detract from the proud self-confidence she was so well justified in assuming.

From the day that steam came to the front, almost simultaneously as it was with the improvements in shell fire, all this was changed. In a few years the transformation from wooden to armour-plated battle ships was completed, and now we have year by year, nay, almost day by day, more fresh and startling innovations in the instruments of naval warfare than were witnessed by two generations of our forebears.

Steam is omnipotent; a wooden ship will soon be a thing of the past; the armoured ship of twenty years back, then never to be surpassed, has become well-nigh obsolete; and with all this we err not when we predict that the immediate future will see far greater and still more astonishing changes than any of those which we have so summarily discussed.

Was there ever before a period in the history of the world when men's brains were so active or their minds so enterprising in the matter of warlike inventions as they now are? More especially is this so in regard to the attack and defence of ships. Surely, then, this is no time for a nation depending entirely on maritime supre-

macy to provide daily food for her people, to pause and take breath over her naval construction, more especially when she contemplates other nations who have few Colonies, and, comparatively speaking, little interest on the high seas, and who, though well-nigh overwhelmed by their military burdens, are yet the most active in naval matters, failing not to seize with both eagerness and aptitude on any new engine of naval destruction, or on some novel design for a war vessel, secretly hoping that by so doing they may threaten the might, or perchance become heirs to the wealth of some greater maritime Power.

If the foregoing be correct, and we ourselves conscientiously believe it to be so—indeed we should be more than happy if it could be openly controverted—then we must pause not in Great Britain to amply sustain the efficiency of our war Navy: and we must do more: we must jealously watch everything that is likely to imperil the great and glorious legacy that has descended to us; we must closely examine and try all newly invented methods of war; if on close examination and experiment we find that any of them contain aught that may endanger our heritage of the sea, we should not hesitate at any cost to assure ourselves of possessing their mastery.

In taking account of the great cost of our Navy, let us always carefully weigh against it the loss that would be entailed upon our country by even a temporary check to our naval power; let us again note the fact of our imports and exports of 1883 having reached the enormous sum of nearly 733,000,000*l.*, while the sum now spent in maintaining the Navy is less in proportion to this tremendous mercantile transaction than in any former year.

Before quitting this part of the subject, let us endeavour to grasp, if only in a small way, the misery and starvation that would be inflicted on our fellow countrymen, women, and children, by even a momentary cessation of this stupendous trade. The supplies of export material would rapidly increase, with no prospect of finding a foreign market; there would be a seriously diminished supply of goods from abroad to fill the home market, which would be glutted with our own manufactured goods.

We feel that we have said enough. The necessity for making any apology for being over diffuse or too argumentative in this or in our following chapters is already precluded. Too deeply do we feel the expediency of any matter that concerns our naval supremacy being relentlessly threshed out and continually kept in view, to dread either criticism or ridicule.

We will conclude our first chapter by drawing attention to the two tabulated forms which we annex, and which are illustrative of the comparative displacement tonnage, armament, cost, and complements of the most prominent war vessels of 1805 and of the present year. It is almost absurd to contrast the difference between the vessels of these two periods, not only on account of their singular diversity of type and construction, but for the ridiculous augmentation of the cost of the later vessels. If then we find that the 1st class ship of the present day to attain perfection must cost 800,000*l.*, or nearly eight

1805.

| Class of vessel. | Tonnage displacement (about). | Armament (about). | Cost (about). | Crew (about). | Capabilities, &c. |
|--|-------------------------------------|----------------------|------------------|------------------|--|
| 1st class, three-decked line-of-battle ship. | 3,500 | 110 guns | £110,000 | 1,000 | Equal to any vessel; superior to all smaller vessels; average speed. |
| 1st class, two-decked line-of-battle ship | 3,000 | 90 " | 90,000 | 800 | Equal to engage any vessel; superior to all smaller vessels; average speed. |
| Frigate, larger type | 2,000 | 50 " | 50,000 | 450 | { Equal to all vessels not line-of-battle ships; superior to all else; faster than most vessels. |
| Corvette, " | 1,000 | 20 " | 20,000 | 200 | |
| Sloop | 500 | 18 " | 13,000 | 120 | Inferior to the above named; superior to all others; average speed. |
| Brig. | 350 | 10 " | 10,000 | 100 | " " " |
| Schooner | 200 | 8 " | 5,000 | 50 | " " " |
| Cutter | 100 | 6 " | 2,000 | 25 | " " " |

1885.

| Class of vessel. | Tonnage displacement (about). | Armament (about). | Cost (about). | Crew (about). | Capabilities, &c. |
|---|---|---|------------------------|---------------|---|
| 1st class, armour-protected vessel, "Italia" type. | 13,500 | 4 very heavy, 8 smaller, and machine-guns | £ 800,000 to 1,000,000 | 450 | Equal to any vessel as far as gun power goes, but liable to be destroyed by swift rams or torpedo-boats; high speed. |
| 1st class, armour-protected vessel, "Collingwood" type. | 9,150 | 4 heavy, 6 smaller, and machine-guns | 600,000 to 700,000 | 400 | Equal to most vessels in gun power, but liable to be destroyed by swift rams or torpedo-boats. |
| 2nd class, armoured vessel, "Audacious" type. | 6,000 | 10 guns and machine-guns | 400,000 | 450 | Speed only moderate, armour thin; inferior to modern armour-clads, &c.; liable to be destroyed, &c. |
| 2nd class, armoured vessel, "Impérieuse" type. | 7,390 | 4 heavy, 6 smaller, machine-guns | 450,000 | 400 | Equal to most vessels; superior to many; speed fast; liable, &c. |
| Frigate, "Inconstant" type | 5,780 | 16 guns | 400,000 | 450 | Equal to an engagement with any unarmoured vessel; unequal to engage armoured vessels; speed good; liable to be destroyed by ram and torpedo-boats. |
| Corvette, "Calliope" type | { Almost obsolete, there are only 2,770 16 guns | | 200,000 | 300 | |
| Sloops | 1,000 | 6 to 10 guns | 70,000 | 150 | Armament good; speed inferior; liable to be destroyed by ram and torpedo-boats. |
| Gun-vessels | 700 | 6 to 8 guns | 40,000 | 100 | " " " |
| Gunboats | 450 | 4 guns | 35,000 | 80 | " " " |
| Torpedo cruisers | 1,430 | 4 light and 5 machine-guns | — | — | Speed very good; able to destroy both armour-clads and other vessels with torpedo-boats, also to destroy torpedo-boats with gun fire. |
| Torpedo-boats | Various sized and priced boats of very high speed, but fragile construction, able to destroy armoured or any vessel with torpedo-boats. | | | | |

times the value of her predecessor of only eighty years ago, what do we suppose the vessel of twenty years' time will cost? We may be sure, even if we had no other ideas on the subject, that this pace cannot last.

Possibly the modern war ship can do eight times as much as the vessel of older type could hope to do, and from the fact of her existence being more in accord with her time, she is undoubtedly of infinitely more value to the State; but neither she nor any of her smaller compeers by any means enjoy the same immunity from the risks of destruction as did their predecessors in the earlier part of this century; for as we have already said and shall frequently repeat, our new ships have to face and fear many and serious attacks that may be easily fatal to their existence, and which attacks will entirely ignore their reputed above-water invulnerability.

And why? Because men's intellects are gradually rebelling against those impossibilities, for whose perfect attainment they have for years been earnestly striving in the as yet never-ended battle between the guns and the plates, and also because they have in part recognized the power that is gained by attacking the armoured monsters of their own creation, with lighter and swifter vessels. Consequently on this recognition and by the exercise of an unbounded ingenuity, they have contrived small vessels that can in smooth water outpace the largest armour-clad, and have armed them with a weapon which places the smaller vessels under certain circumstances on a more than equal footing with the greater.

If this has been done with small and light vessels, what new and surprising developments of power and speed may we not expect in the almost immediate future, when the same successes that the smaller vessels have achieved are attempted with vessels of from 500 to 700 tons displacement? We cannot ourselves see any reason why a smooth water speed of from 25 to 30 knots could not be attained in such vessels, that is, if all else be sacrificed to speed; two or three machine-guns and some twenty Whitehead torpedoes to be the limit of their armament; the latter should be ejected from positions on the bows, beams, and quarters, as well as right ahead and right astern.

Vessels of the above type should be more than a terror to those monster armoured vessels that both we and other nations fancy we are obliged to create. Such vessels would be too swift in themselves to dread either the ram, the torpedoes, or the torpedo-boats of the huge vessels they would attack; and whose guns they would half muzzle by choosing the hours of darkness, fog, rain, or mist for their opportunity.

If the above presumptions be tenable, then high speed must be the ruling factor of modern naval wars.

The stubborn combat of ships broadside to broadside will be a thing of the past, its place will be usurped by the fight of swift vessels, manœuvred by the skill, activity, and strategy of a highly-trained personnel.

Thus may come the solution of that problem of which we are so tired, "guns *v.* plates;" but it has not yet come to this, and in our

ensuing chapters, we shall strive to deal not so much with the problematical as with the real, and confine ourselves to writing as we are required to do, on "the changed conditions of naval warfare" as we now know them.

CHAPTER II.—*The Ram.*

Closely following the improvements in shell-fire, and more closely following the absolute victory of steam over sails as the propelling power of ships, and upon which we have already commented, came the introduction of the ram as a leading naval weapon. There was no need to wait for a naval battle to enforce attention to its extreme power; the almost daily collisions of our merchant steamers were themselves living witnesses of its potency.

There was no need to resort to ancient history, therein to study the famous tactics of the Romans, as with their well-manned and rapidly-propelled galleys they sought by means of the ram or beak to rend and sink their foes. Beaten eventually in the past by the improved methods of shipbuilding, and the more skilful use of sails, the ram vanished for centuries, but at the bidding of steam skilfully applied, and used to drive ships rapidly in every direction, it has in the present reappeared, not only quite as formidable as of yore, but with greatly increased powers.

What can equal the destructive force of a ram propelled at 12 knots or possibly at a higher speed, bearing on its point the whole weight of a 10,000-ton ship?

What a weapon! The blow when dealt does not waste energy above water, it probably will avoid armour-plating; it is not liable to ignominious failure like a locomotive torpedo by reason of non-explosion; no explosion is necessary. Deliver its blow ably and with seamanlike vigour, and it will crush, rip, or rend the very vitals of a stricken vessel.

But with all this said or done, the blow of a ram is not mechanical. Whether it shall be effectively used or not, depends on many circumstances or causes: we will name some of them.

The successful use of the ram in a naval action must, in the first instance, hinge on the nerves of steel and the keen and well-trained judgment of the seaman who guides and controls the ship that bears it; constant practice in manœuvring his ship at all speeds must have made him thoroughly the master of her every movement. She should respond to his will as quickly as the well-trained horse obeys the least touch of the rider who is familiar with him. In the second place, the successful use of the ram must depend on the comparative speed and turning power of every ship; high speed and rapid turning power make any ship an efficient ram.

In an engagement between two hostile vessels having anything like an equality of speed and turning power, we think it improbable that there will be any ramming.

Given, however, higher speed and equal turning power, and the option of ramming should rest with the fastest ship.

Given higher speed and less turning power, all attempts to ram the handier ship will be futile, presupposing, however, in all these cases, that the two engaging vessels do not deliberately seek a stem to stem encounter. If they do, then arises the question, will it be fatal to one or both of these determined foes? We venture to say that it may not be fatal to either, apart from the extreme difficulty of two vessels hitting each other end-on; and if two ships, rapidly approaching each other stem to stem, are able even to keep a steadfast course, still then, not once in a score of attempts will point of ram meet point of ram; no, we say that even if they strike each other, the bows will often glance and deflect. The two vessels it is true may meet with a fearful crash, and then with a terrible dismantling of outside hamper rush rapidly past each other, only to swiftly wheel and renew the charge. But let one adversary through a weaker courage, perhaps merely through an error in judgment, fail to oppose her stem to the stem of her foeman, and thus expose by a yard the broad of her bow to the ram of the enemy, swerving either to starboard or to port, it matters not which, then if eye be keen and judgment good, the point of her adversary's spur will be swift to penetrate the flimsy bottom plating opposed to it, and the velocity of the stricken ship will materially assist in effecting her own rapid disablement or destruction; witness the "Vanguard" and "Grosser Kurfurst" disasters.

When two ships have rapidly passed each other perhaps structurally uninjured, or may be without colliding, then will come the opportunity to test the skill of the Captain of either vessel; then will be shown whether one or both understand thoroughly the manœuvring powers of their ships. The Captain who is well trained, and who has by frequent practice instinctively become the master of his vessel's every movement, will decide at a glance and by force of intuition, whether he will wheel to starboard or to port; he will know at what speed his ship will best make a rapid semicircle; he will have no doubt as to whether he shall reverse or stop either of his engines; he will be saved from making any error that might be fatal to himself; and he will from his well-trained promptness be ready to take every advantage of a false move on the part of his enemy.

With all this written and undeniable, we do not allow that the full power of the ram can be generally developed in a single-ship action; on the contrary, we say that in proportion to the number of ships engaged in a sea battle, so will the power of the ram increase. Smoke, confusion, disablement of engines, steering gear damaged, error in the manœuvres of a fleet, all or any of these circumstances will make a favourable opportunity for the use of the ram. Of this we have a notable example in the action off Lissa, while in the few single-ship actions that have occurred since the ram has been modernized as a naval weapon, all attempts to use it with vessels each under command have been at the best futile or abortive.

In exact contradiction, however, to the action off Lissa, and to the lesson taught us by the gallant Tegetoff, we hold that the ram ought to be the weapon of the fleet which is numerically the strongest; all

other things being equal, it seems almost self-evident that a force superior to another in numbers, say to the extent of three to two, must have a decided advantage so far as ramming is concerned ; with gun-power alone the advantage may lie with big guns and thick plates, the guns and torpedoes of a ship may be fought on either side or both sides against superior forces ; but with three rams seeking to destroy two rams, nothing but greatly superior speed or skill can equalize the combat.

It is most important that the Captain of every fighting ship, more especially of a ram, should be favourably placed and adequately protected when conning his vessel. We have shown that in all attempts to ram, the opposing vessels must pass and re-pass each other at very close quarters, so close indeed, that we may presume that all persons exposed to the fire of machine-guns and rifles will rapidly be placed *hors de combat*. It is our deliberate opinion that fairly roomy conning towers, well plated, or at least made proof against machine-gun fire, should be placed amidships in every ship, about one-third the length of the ship from the bow, and commanding a good all-round view ; in this the Captain and Navigating Officer should be placed, while immediately underneath them, and well armoured and protected, should be the steam steering wheel, and all communications with the engine-rooms, guns, magazines, torpedoes, &c. It would be absolutely impossible to effectively conn a ship in action from the after-bridge. All ships are best conned from the place on which they pivot in response to their helm, to successfully use or avoid the ram or the locomotive torpedo. A full view of the enemy should be obtained over the bow.

The ram is in every sense a weapon of attack, it is in no sense a defensive weapon.

In another part of our essay we shall attempt to show how the attack of rams may be frustrated or deterred by torpedoes, but in this chapter we purpose to confine ourselves to the exhibition of the power of the ram as a weapon. To further do so, let us picture to ourselves the sudden meeting during a war of two steamers at night. They would come upon each other suddenly and probably unexpectedly, there is no time for private signals to pass ; each vessel hurries to quarters ; steam is ordered for full speed in both ships ; each Captain feels that if he could be sure the other was an enemy that he could sink him before a gun was fired. What an opportunity for that Captain who had good reason to be sure that the other vessel could only be a foe !

The slowness and uncertainty of private night signals would be awful under such circumstances.

Do not let us lose sight of the fact that a blow from the bow of any of our merchant steamers driven at sufficient speed would either sink or disable most men-of-war.

How are our Captains to avoid placing their ships in danger of such a catastrophe ?

Will it be the duty of a steamer on first meeting another at night to turn from her at speed until a private signal is answered or dis-

regarded? or should she close on the stranger's beam and hail as of yore? All these are questions the ram has forced upon us; they require to be carefully studied and worked out during times of peace.

In most cases of hostile vessels meeting at night the decision as to who will be rammer or rammee must be prompt, sharp, and decisive. What applies to a single ship in this matter applies much more forcibly to both squadrons or fleets. A hostile fleet caught or surprised at anchor or with low steam, is a fleet lost.

Before quitting the ram, we think we may here fittingly say a few words as to the construction of ram bows, having reference more especially to large armour-plated or battle-ships. Annexed are drawings of the rams of our "Collingwood" and the French "Amiral Duperré;" where there is so much difference in the design and contour of the bow, it may fairly be taken as a matter for criticism which is better or worse than the other (see Plate XI, Figs. I and II).

To begin the argument, we will frankly admit that undoubtedly a fair blow from either type would be effective against the side of any antagonist, but with two ships, each manœuvring to ram one another, the blows will not be delivered at right angles to the keel of the enemy, but probably at very oblique angles with each ship moving at a high speed; in any case when the ram of one vessel has struck the other and has penetrated her side, it will be at once exposed to severe lateral and wrenching strains, under whose influence, if the ram be not of sufficient strength to slew the ship before yielding, it will surely twist and perhaps be wrenched off. We will for the moment say nothing as to the effect on the ship rammed, but concern ourselves only with the rammer.

The instances we have to guide us are the collisions of the "Osprey" and "Amazon," when the latter rammed and then sank. She, it is true, was only a wooden ship with a weak ram, but she rammed a weak ship. Later, the "König Wilhelm" and "Grosser Kurfürst," the former being only saved by her watertight bulkheads, the ram being both damaged and twisted; later, again, the "Defence" and "Valiant;" here the blow of the ram was very oblique, and it suffered more than the side of the rammed ship; being of very weak construction the stem itself was fractured in two places.

Turning now to our Diagrams, Figs. I and II, let us compare the shape of the "Collingwood's" bow and the ram that arms it with that of the "Duperré," then briefly sum up the merits or defects of either as they appear to us. We grant first, as we have said before, that either ram would be sufficient to waterlog or sink a similar vessel if a fair blow were struck "end-on" to broadside at any speed over 8 or 9 knots; let us, then, in imagination consider this blow struck, and discuss its effect on the rammer.

It is evident that in the case of the "Duperré's" ram much greater penetration would be effected, her receding cutwater would penetrate farther, more easily, and with less shock to herself. The ram of the "Collingwood" would penetrate with equal ease until the vertical stem came into contact with the armour plates of her foe, when it is

not unreasonable to suppose that she would be stopped more abruptly and with greater damage to herself than the "Duperré." Vide Figs. I, II, and III.

Again, at lower speeds the sharp and ripping ram of the "Duperré" would have to our mind a decided advantage over the shorter and blunter ram of the "Collingwood," it would be more likely to effect penetration when an oblique blow was struck, and it would from its length and greater projection under water be more likely to strike and damage the rudder and screws of an adversary, having a far better chance of getting under a projecting counter.

As to the comparative strength of the two types of ram which we are now considering, we offer our opinion with much diffidence, but we feel constrained to say that we again prefer the bow of the French vessel; in the first place we like the armour extending to the point of the ram; we know that it is argued that the armour so extended does not contribute to the actual penetrative strength of the ram itself; even admitting that it does not do so, yet it must certainly render the point of the ram less liable to injury from shot or shell, and the protection it will afford to the thin bottom plating against lateral strains after the ram has pierced the bottom of any enemy is not to be undervalued; the sudden wrenching strain that must fall upon the ram of a heavy ship after striking an enemy in rapid motion must be enormous. We do not attempt to deny that the ram of the "Collingwood" must derive great support against such strains from the extension of the armoured deck to the extremity of the ram, but great as this may be, can it save the thin side plating from injury?

Then, again, in these days of large double bottoms, wing passages, and other minute internal subdivisions of ships, it may be fairly argued that a long and extended ram is likely to inflict greater injury than a short one. An idea is prevalent with some people that a ship with a long ram might on ramming penetrate too far into the side of another vessel, and that the ramming ship being unable to back out and clear herself might share the fate she inflicted on her enemy; there never was a greater fallacy; hitherto in every case of ramming or collision the striking ship has had no difficulty in rapidly clearing herself by backing her engines. We have personally conversed with some of the Officers of the Austrian armoured wooden frigate that sank the "Re d'Italia" at Lissa; they all stated the shock to be slight, and said there was not the least difficulty in backing out to renew the blow. We have heard similar statements from an Officer of the "Iron Duke" after she rammed the "Vanguard," and quite recently we have seen an iron steamer that had a few hours before at night steamed into the middle of a large barque, not stopping until she had penetrated the unlucky vessel as far as her (the steamer's) foremast, backing out at once before the barque sank, the only visible injury to the steamer being a few scratches on the paint on each bow, made by the crushed timbers of the riven vessel.

Every vessel of decent speed, large or small, should have a ram bow, which though of necessity in some cases too slight in construc-

tion to be used against a heavy ship, yet might always be sufficiently strong to be advantageously used against vessels of considerable size.

We were much taken some time back, by a remark made by Captain Gerard Noel, R.N.; he then stated—if our memory does not fail us—that in regard to lateral and wrenching strains the U-shaped bow was probably superior and better adapted to give strength to the ram than the V-shaped bow; we entirely coincide with his opinion in this matter.

Let us conclude this chapter on the ram by asking what is the best defence against it? The answer will be high speed and rapid manœuvring power; but these qualities are to some extent antagonistic to each other: true, then let us have high speed first combined with the best turning power that can be obtained in addition to it.

To mitigate as far as possible the fatal effects of being rammed, large double bottoms, ample wing passages, fore and aft bulkheads, and many watertight compartments are absolute necessities; no war vessel can be pronounced efficient unless she is so constructed. Also it will be wise to keep the outside of the ship as flush as possible, avoiding all weak projections, &c., &c.; anchors, guns, &c., should be kept well inboard; as we have shown before, two vessels rushing past each other end-on having failed to ram, would make a clean sweep of all outside hamper.

CHAPTER III.—*The Torpedo.*

We propose to limit our remarks in this chapter to an exposition of the value we attach to the locomotive torpedo only, meaning by the term "locomotive," those torpedoes which are either automotive by reason of having motive force stored within themselves, or which are propelled by the velocity of the ship or boat that is armed with them, or those which by some other means can acquire a motive power, reserving all notice of the stationary or torpid submarine mine for another page; the locomotive torpedo will be in nearly every instance used as an aggressive or offensive weapon, while the submarine mine, often miscalled as it is, a torpedo, may be correctly characterised as a strictly defensive weapon, its use being solely confined to the purposes of defence.

Treading very closely on the heels of the ram the locomotive torpedo promises conjointly with it to revolutionize the whole system of naval warfare; there is a similarity about the uses of the ram and the locomotive torpedo, indeed the latter has been not inaptly compared to a flexible extension of a ship's ram.

In actual warfare it will be proved on many occasions that the locomotive torpedo will ignore the power of the strongest, the heaviest armed, and most formidable ship that the laborious ingenuity of man can produce, and reduce it down to the level of the smallest, and we may even add the most fragile of her antagonists.

On close enquiry, however, it appears that it is not so much what actually has been done in the way of destroying large and costly

vessels by smaller and less costly craft, but what is expected to be done in this way in the future, that hastens all nations to not only re-arm their larger vessels, but to create in addition to them a numerous flotilla of small swift vessels, all to be armed with offensive torpedoes as their principal, if not only, weapons.

It is needless for us to say much concerning submarine boats in our essay; their success has so far been exceedingly limited, for although several nations have attempted their use and development, they have all more or less failed, and we believe that with only one exception, these "Davids" or submarine boats, have in actual war, or in experiment, generally succeeded in drowning their own crews before doing much practical service; we are not, however, rash enough to say that if certain difficulties concerning their total immersion can be overcome, and more especially if stored electricity can be applied as their motive power, that there may not yet be a future for these under-water craft, admirably adapted as they would be for efficiently discharging locomotive torpedoes without an enemy having the least suspicion of their immediate proximity; we feel, however, that we are quite justified in disregarding the use of submarine vessels at least as far as their employment would affect the naval warfare of to-day, there are, as yet, no changes in its conditions due to the employment of such craft.

The best known of all locomotive or automotive torpedoes is "the Whitehead;" there are in addition to it "the Lay," "the Brennan," "the Sims," "the Berdan," and others; of these the Whitehead alone can at the present time be pronounced adapted for use as a seagoing offensive weapon.

This beautiful and fish-like torpedo, when skilfully handled by those well trained to its use, becomes a swift and deadly under-water projectile; its beautiful and ingenious mechanism once correctly adjusted requires no further guidance from the hand that launches it; equally effective whether launched from ship, boat, or shore, it is capable of carrying its destructive charge of 65 lbs. of guncotton to a distance of 800 yards at a speed exceeding 22 knots an hour; it can also be regulated so as to travel nearly a mile at a slower speed before its motive power of compressed air is entirely expended. At such a long range its practice must necessarily be somewhat uncertain, but when limited to the shorter range and started at the high speed first mentioned, and in smooth water, with little or well estimated current, it is a weapon that may well be dreaded by the large and costly armour-clads of to-day; which can by its agency be disabled, or even be destroyed, almost before they have become aware of the near presence of their destroyers.

Here there can be no prospect of a fair and open combat, we can have no ship matched against ship, gun returning gun: no! the insidious approach of a swift torpedo-boat may, especially at night or during a fog, prove that for once the weak are strong, and that at times the strong are impotent.

We regard the Whitehead torpedo as more essentially the weapon for light and swift vessels; it is true that they can also be effectively

discharged from heavy vessels, but there is always a remote danger of the torpedo not getting clear away, perhaps from bad management, or in a heavy seaway, thus admitting the possibility of some valuable vessel being "hoisted with her own petard;" recent improvements in the Whitehead have, however, rendered such an accident exceedingly remote.

There is, we fear, much danger to be apprehended from an indiscriminate use of the Whitehead torpedo in a fleet action; here it may, if carelessly discharged, as easily destroy a friend as a foe. Moreover, we believe that considerable risk is run from the liability of an inboard explosion, especially when the torpedo is placed above water, and is in readiness for launching, from the effect of machine-gun fire, shell exploded in the vicinity, &c., &c.

The Whitehead torpedo is not likely to be effective in a heavy sea: it may when launched under such conditions from above water keep its course straight enough, but we doubt its preserving its proper depth; the weak point of the Whitehead is the extreme undulations it often makes below the surface when first started, in a heavy sea it could not well run either on or near the surface.

A first acquaintance with the value and merits of the Whitehead torpedo would lead to the not unnatural belief that the general and extended use and adoption of such a weapon would have a strong tendency to reduce that nation who is most powerful at sea, and who has hitherto trusted to the general prowess and invulnerability of her armoured ships, down to a nearer equality with previously weaker maritime nations; if the study and practice of locomotive torpedoes is neglected by us, we have already acknowledged that this may be so. But farther on in our essay we shall endeavour to prove that if we in England do not stand still, but, on the contrary, boldly face the general adoption of locomotive torpedoes as novel but potent factors in naval warfare, then, instead of their use being very much to our disadvantage, we may even make them contributory to the support of our great naval power: certainly they will add largely to the protective strength of our Colonies.

The outrigger, or spar torpedo, can alone depend for its locomotive power on the speed of the vessel which is armed with it; whether carried at the end of an outrigger spar in the bow of a boat, or from the end of a boom in a larger vessel, it may be with justice, in either case, pronounced a most formidable addition to the weapons of naval war. Already its bold use from boats has commanded many and great successes, while its employment when extended from the end of a boom in large ships may in the future lead to some very remarkable results.

Controlled by electricity instead of by a fuse, the spar torpedo has become a safe and docile weapon, which when wielded by the bold and courageous seaman, can be terribly destructive to the largest vessels.

It is true that for the rapid and swift torpedo-boat the superior advantages of the Whitehead have theoretically displaced it, but it is well to remember that while the outrigger weapon has scored many

and great successes, the Whitehead has as yet not had one definite success in actual war.

The disadvantages inherent to the spar torpedo are that the poles are cumbersome and liable to bend or even to break when they are submerged if the boat is going at high speed, thus necessitating a slower attack than with the Whitehead; when rigged out they will of themselves much reduce the boat's speed; also, the attack having to be made in close proximity to the side of an enemy, the danger to the crew of the torpedo-boat must necessarily be very great, while excellent practice can be made with the Whitehead at even 500 yards distance; again, it is far easier to rig temporary defences to guard against the attack of a spar torpedo than against the Whitehead; nevertheless, despite these disadvantages, the outrigger torpedo is to our mind fully the equal of the Whitehead in other ways; it is a weapon well suited to an impromptu attack, and cannot be superseded as a formidable weapon in the hands of a daring and capable Officer. Unlike the Whitehead, it is not a costly weapon, it will seldom fail, it requires less instruction to learn its uses; lacking a supply of Whiteheads, a modern man-of-war can with her own materials and resources construct in a very short space of time a fairly serviceable outrigger torpedo.

The darkest night or the densest fog affords the best opportunity for the use of the spar torpedo; under such conditions it should always excel the Whitehead, for there will be no liability to misjudge the distance or the force of a current; the blow, when dealt with courage, will be struck home with no chance of failure.

The comparative merits of the Whitehead and spar torpedoes have been aptly rendered in the following words; we quote them, for we feel that we could not better the lucid illustration which they give.¹ "The spar torpedo is the dagger which, at the risk of his life, a determined man will plunge into the heart of his enemy. The Whitehead torpedo is the bullet that can easily be projected from afar, and can kill the enemy on its path, but which also will often miss the object aimed at."

In the event of a fight between two boats, the one armed with the outrigger, or pole torpedo, the other with the Whitehead, it appears that the former would have the best chance; it would be no use discharging a Whitehead at a small boat, but the boat with the pole could keep her pole facing her enemy, who dare not approach it too closely.

The outrigger torpedo is also certainly very formidable when extended from the boom of a big ship. Being completely under the control of the operator, electricity has converted it from a very unsafe to an absolutely safe weapon; there is now no danger should it fall alongside of a premature explosion, injuring its own vessel; nothing can explode it until it is brought into actual contact with an enemy, then the eager and willing but equally docile electric current is released, and the charge fired.

¹ *Vide* Brassey, vol. ii, p. 191.

Towing torpedoes have well nigh had their day; the difficulty of working them, and the necessity of exposing the men who do so to the full fire of the enemy, has all but terminated their existence. Harvey's towing and diverging torpedo was tried and was for some time in use in Her Majesty's Navy; the French also made use of a somewhat similar weapon, but were not satisfied with it. The Whitehead, indeed, seems to have quite displaced it in all countries.

The use of towing torpedoes cannot but be attended with considerable risk to those who tow them, there is always the contingency of the wire tow lines fouling the propeller; they also largely detract from the speed of small vessels, and much restrict their power of rapidly manœuvring, and frequent experiments conclusively proved that it required the greatest skill, judgment, and good seamanship to successfully place one in contact with the bottom of an enemy's vessel.

In fleet actions where well preserved close order would of itself be a large element of success, the use of towing torpedoes becomes an absolute impossibility. The only occasion when, we think, it might be justifiable for a Captain to use a towing torpedo, would be when he knew that the superior speed and turning power of an antagonist made it almost certain that he would get his ship rammed; in such a case, and then only, we believe that a torpedo towed astern might serve to embarrass his enemy, more than it encumbered his own movements.

The Lay locomotive torpedo, controllable and self-propelling though it may be, is yet not to our mind a seagoing weapon; we have the strongest doubts as to the practicability of any torpedo which when started from a vessel requires attachments to her, as the Lay does, to guide it on its course. Here what might prove an advantage to it if fired from the shore becomes fatal to its success when used with a ship or ships in rapid motion. The speed of the Lay torpedo is, at present, slow; and we also object to the way its motive power is derived, especially for ship use. It is reasonable, however, to suppose, judging at least from the nature of the reported experiments, which we have read, that this torpedo may be of service when the Whitehead is not available. Started from the shore, where its great weight may be less inconvenient than it would be afloat, the heavy bursting charge which it carries would prove exceedingly destructive. The Russians and Turks are both supposed to have made successful experiments in its use, but at present we do not think it can be fairly claimed by those who advocate the Lay torpedo that it will be a factor in modern naval wars.

The other locomotive torpedoes, viz., the Brennan,¹ the Ericsson, the Sims, &c., we have had no opportunity of studying, it would appear that they are yet in their infancy; but we admit, without hesitation, that if the locomotive torpedo should succeed in maintaining during a war even a part of the great *prestige* that it has

¹ We had written this before the successes of the Brennan torpedo were made public. In the face of its remarkable success we still do not think it a weapon generally adapted to naval use.

advanced in peace, then that the Whitehead will have to face many rivals, as well as improved types of Lay, Brennan, and Ericsson torpedoes, over which it is at present, for naval purposes, actually paramount.

We understand that it is in contemplation by foreign Powers to have batteries of Whitehead torpedoes arranged for the defence of the narrow entrances to some of their ports; placed beneath the water and under the cover of guns, these Whitehead batteries are to be capable of discharging their torpedoes either in flights, or singly, at the discretion of an operator who would be unexposed and acting in perfect safety, it would be akin to madness to wantonly expose valuable armour-clads to the risk of such an assault.¹

In assigning a proper value to the torpedo, we should do well to bear in mind that with the exception of some chance shot it requires a very considerable amount of hitting, and a very much greater amount of firing from guns, to disable a ship entirely, also that the blow from the ram may be deflected if it happens to strike obliquely; but the torpedo, if well aimed in any sort of contact with a ship's bottom, must be absolutely fatal to her further fighting efficiency; for instance, it was recently proved, at some experiments in Sweden, that 33 lbs. of dynamite exploded at a distance of 4 feet from a well-built target, representing the bottom of the "Hercules," blew a hole in the inner skin some 70 square feet in area.

There can be no doubt that in actual warfare the locomotive torpedo will in the future further demonstrate its tremendous powers of destruction.

High speed and great mobility seem to be the only tolerably effective safeguards against such a terrible weapon.

CHAPTER IV.—*The Submarine Mine.*

Under this heading we propose very briefly to say a few words concerning those mines which are submerged and stationary, and which, though they are torpedoes in the first acceptation of the term, are now for the sake of distinction more generally designated as submarine mines. When compared with their locomotive and automatus brethren they are no novelty, submarine mines of a rude type having been employed years ago.

Submarine mines, when in position and submerged ready for service, either rest on the bottom by the force of their own gravity, or they are moored by anchors or weights; the greatest difficulty is experienced in keeping them at the proper depth, especially when there is a large rise and fall of the tide; we believe, however, that a recent clever invention has made the submarine mine of the future self-acting and capable of automatically preserving its proper depth.

¹ We have omitted to mention the coal torpedo. This base and cowardly weapon has been, and may be again used in naval warfare, though it is more appropriately the instrument of the Fenian and "dynamiter," than the civilized nations of to-day.

The original submarine mine was entirely mechanical in its action, the explosive with which it was charged being ignited by the shock of some passing vessel striking the mine and putting the firing mechanism in action; these purely mechanical mines were dangerous alike to friend and foe; great ingenuity has been exercised in perfecting the firing mechanism, and there are many plans that have been practically tested in actual warfare. Mechanical mines were largely submerged by the Russians in 1854 and 1855, by the Confederate States during the Civil War in America, and still later by other nations; they have scored some great successes, but being dangerous, both to lay down and to remove, their true motto is "*Nemo me impune lacessit*;" for this reason their use is being much restricted and will probably be altogether discontinued.

The more scientific submarine mine of the present day is exploded by electricity and is far in advance of its older prototype; being at the pleasure of its operator either mechanical or at will fired by two observers stationed on the shore, they are perfectly safe to passing friends; they can also be laid down or removed by their owners without the least danger if proper precautions be observed.

The modern submarine mines that are fired by electricity may be divided into three classes:—

The "electric mine," which depends on two observers, each at a different station, noting that a vessel is close to a mine, and who, by jointly completing the electric circuit at their respective stations, explode the mines; this is sometimes called an observation mine.

The "electric contact mine," which can be either fired as above, or explodes on being struck by some vessel; this system, advantageous as it is, involves many complications and renders the mines difficult to test, but has the very positive advantage of being self-acting during night or fog, when the trespassing vessels would be hidden from the observers.

The "electro-mechanical mines," which have a small battery contained in them, and which is used to explode them, are, however, quite as dangerous to handle as the old mechanical mines before described.

Drifting torpedoes, or submarine mines, were employed against our ships in the old Chinese war; and also very lately by the Peruvians, who, by means of mines concealed in drifting boats, blew up two Chilian vessels; many daring and crafty stratagems will be tried during the next war on similar principles.

The proper function of the submarine mine in future naval warfare will be the protection of ports and harbours against the sudden inroads or aggressions of an enemy; when securely placed under observation and supported by the fire of batteries, mines become most formidable, and their maximum defensive power is reached; otherwise, their effect on the shipping of an enemy is known to be chiefly moral and deterrent, and their removal or destruction becomes only a matter of detail, time, and caution.

No attack that has been carried out with determination by ships against a passage solely defended by submarine mines, or even defended by mines that are only weakly supported by guns, has ever

failed; the mines have delayed the ships and have inflicted some very severe lessons on those who first sought to pass them; but taken as a result the mines have always been beaten; we think they always will be; in proof of this assertion, we draw attention to the attack of the Federal ships on several of the Confederate ports and rivers; and later still to the naval part of the war between Brazil and Paraguay. It is true that the mines never failed to exact some severe penalties from the ships; in the first quoted attacks the Federals at different periods lost seven armoured vessels, mostly monitors, besides eleven unarmoured craft, all blown up or sunk by the action of what we should now call very primitive submarine mines; in addition to these casualties, several other vessels were at odd times injured and temporarily disabled from submarine explosives; but all the same, history records that the ships were not kept out.

In the Brazilian and Paraguayan war to which we have just alluded, an armour-clad vessel of the former nation was, while making an attack on a fort, broken almost in two by the explosion of a submarine mine, sinking at once with most of her crew; daunted but not deterred by this disaster, the Brazilian fleet eventually overcame both the mines and the batteries that supported them.

We have also already alluded to the destruction of two Chilian vessels by mines concealed by the Peruvians in drifting and apparently abandoned boats which on being hoisted up or roughly overhauled exploded, at once destroying their Chilian captors. A lamentable want of caution was exhibited by the Chilians, in both instances they had actually been forewarned but were over-confident; in future, all drifting boats should be examined at a safe distance from the ship, and no strange shore boat should be allowed near without being first boarded and overhauled.

There can be no manner of doubt that electric submarine mines will, during the next war, largely enter into the defence of all sea-ports, and that when their removal is actually necessary in order to force the entrance to a port, special ships will be employed to effect it; of these vessels we shall say something in a later chapter.

But stationary submarine mines will not be alone of use for the defence of ports and rivers, on many occasions they will be of much service to the blockading ships, who can lay a line or two of mines outside the defensive mines of the place, and thus close all egress and save themselves much anxious watching and care.

Submarine mines will be invaluable as harbour defences to our outlying and sparsely populated Colonies, and may save them from bombardment or from paying tribute to the sudden visit of some hostile cruiser who could not well waste the time off the port that would be necessary to remove the mines.

So far in our essay we have confined ourselves to explanatory details concerning the novel weapons that will be used in the naval warfare of to-day; we have done so in the endeavour to simplify the latter part, by at first exhibiting the values we attach to the ram, the torpedo, and the submarine mine; we hope thus to be more explicit and also to free our following chapters from much explanatory matter

with which, had we done otherwise, we should have been compelled to interlard them.

We have also up to the present purposely omitted direct reference to the improvements in naval ordnance, quick-firing and machine-guns, torpedo-nets, torpedo-hunters, &c.; they are all of course intimately connected with the attack and defence of ships, and enter largely into the changed conditions of modern naval warfare. We think, however, that we shall deal with them in a more effective and more appropriate manner if we reserve our ideas as to their employment for our later chapters, more especially for those chapters in which we shall deal exclusively with the attack and defence of ships and harbours.

CHAPTER V.—*Training of Personnel.*

We infer from the text of our essay that the question of training personnel with which we are required to deal, is that which mainly applies to the use of the ram, the torpedo, and the submarine mine; but after much thought and a close examination of the matter, we find the connection between the general education of both Officers and men in seamanship, gunnery, ramming, and torpedo work to be so intimate, that it is impossible to deal effectively with the subject if any distinct separation be made.

Surely it will be on good seamanship alone that we must rely, so that our rams and locomotive torpedoes are successfully handled, or those of an enemy avoided; it will certainly only be by seamanship of a high order that a dangerous channel is cleared of submarine mines; it will be by good seamanship and gunnery combined that the attack of a flotilla of torpedo-boats is beaten off or frustrated; and it can only be by a fleet manned by Officers and seamen who are well trained in all the above that a blockade could be established and maintained.

This being so, we crave some indulgence from the referees to whom our essay will be submitted, if they should consider that we have in any way strayed outside the limitations of the subject as imposed by the Council of the Royal United Service Institution.

It has been sensibly remarked, and it would be hard to contradict the truth of the assertion, that in the present day no amount of matériel, even if it be of immensely preponderating power, can be of proper value as a fighting quantity unless it be manned and worked by a well trained and courageous personnel.

Let us take it for granted then that the first requirement of a naval Power—a naval Power we will say to whom the freedom of the seas is an absolute necessity—will be a highly educated and disciplined body of naval Officers and seamen; a body of Officers so fully educated as to embrace the arduous duties of their profession from no narrow point of view, but with all the vigour of a well trained and cultured intellect; a body of seamen who from being inured to the sea have had their manliness and bodily activity improved and strengthened, and their nerves and courage hardened by the daily vicissitudes of a sea life, and yet withal possessing sufficient educated

intelligence to grasp with ease the more simple portion of modern scientific naval warfare.

For our blue-jackets then we would have, if we could, the daring and hardihood of the seamen of old, or sailors, as they might then be equally correctly denominated, grafted on the wit and intelligence of our modern seaman gun and torpedo man, then perhaps we might have a perfect article; but it is absolutely impossible that we can have such a profound combination of excellence, the daily routine and life on board our latest steam man-of-war utterly and entirely prevents such an alliance of good qualities. It has been well said that it is just as impracticable to expect the seaman of to-day to be the old salt of bygone days, as it would be to expect the latter to fulfil the duties of the valuable seamen of these days of high pressure and rapid transition; it is impossible! the race of men is too entirely different, and we may be thankful that it is so. The older type of seaman, with his extreme repugnance to drill and his happy-go-lucky but generous nature, would be of little service to us, holding us, as he probably would, in supreme contempt as a something lot of lubbers. Could he take our place? No, most certainly not; the transition from sail to steam would have been too abrupt for him; let us, as we have said before, be thankful that it is so, and fully recognize the fact that the wise means adopted by the State for training our young seamen has given us a valuable if not in all classes a sufficiently numerous body of men wherewith to fight our sea battles of the future. So let us, and those who follow us, endeavour to ensure in future that our methods of training and educating our young seamen shall change and keep pace with the times, thus making our coming seamen efficient for the work they will have to do, wisely omitting from their course of instruction all that is rapidly becoming obsolete, and adhering in far greater measure to the production of a seaman, not necessarily a sailor, who is well able to take part in the skilled warfare of this era of steam and explosives.

It might be right here to say that the improvement in the whole tone and character of our men-of-war's men of to-day is due in great measure to the skill and ability with which the boys' training-ships have been organized and conducted, we have little to say that would be worth saying as to improving the training of our blue-jackets until after they leave the training-ship; perhaps some obsolete sailorizing still remains in the course of instruction, the time given to which might be as well or better devoted to the acquirement of more useful matter; but where our system fails is, that after well heating our iron we do not keep it hot; having completed their training in the training-ships, the lads ought at once to be sent to ships in which they would have a fair chance of keeping up what they have learnt instead of going to a harbour dépôt ship, or a mastless armour-clad, they should have the benefit of at least two or three years' sea-work before being exposed to the demoralizing influence of a harbour ship.

Much that we have said of the man equally applies to his Officer. Our glorious naval history proves that our naval Officers have always been men in advance of their day, and it is to this fact as much as to

the excellence of our seamen that we enjoy our present high naval *prestige*.

But does the embryo naval Officer of to-day start on the same footing of equality as regards the acquirement of his professional knowledge as his predecessor did in those days when our Navy achieved such glory?

Yes, in theory he has a far better chance than they had, but in practice, no. They, without any preliminary training, became from long cruising, constant sea-work, &c., after much hardship, absolute masters of their profession; it was truly a hard course, from the early dipping of hands into the tar bucket to the long and severe cruises on a limited supply of water and constant salt provisions; daily encountering or watching for the enemy; constantly battling with the wind and weather; this made the man what he was. Let us mark this result, for it contains a lesson to us. It should teach us that with all the theoretical education which we can and do give our young Officers, they will yet be inefficient unless we give them plenty of sea-work, and let them thoroughly acquire the practice as well as the theory of their profession. Let us boldly face the fact, that although now-a-days we don't want to, and indeed cannot, make our Officers sailors in the sense that they should thoroughly understand the use of masts and sails, yet that we do want them to become practical seamen, and that we know they have three times as much to learn as they had in days gone by.

If an Officer has become a thorough seaman in addition to having a good knowledge of the means used to conduct the scientific warfare of the day, we may rest content that we have got a man who may be of inestimable service to his country, and who, should the opportunity occur, would generously repay this country for giving him so ample and costly a course of training.

The question now arises as to how this course of training is to be given. It is a question that has been often and well discussed, and by wiser heads than ours, and recently, but that shall not deter us from adding our voice to that of those who have raised theirs on a matter which so deeply concerns the welfare of the nation. We are fully imbued with the stern necessity that exists for making our naval education march with and abreast of those rapid changes which are daily being made in naval warfare, and we are conscious that our ideas are well meant, and we are not ashamed of them, even if they are thought devoid of value.

To begin, we will assume that the merits of any system of naval education will become most apparent as the Officers whom it has trained and developed reach first the bottom and then the middle of the Lieutenants' list; until an Officer has become a Lieutenant of from three to five years' seniority we say that he is still daily and rapidly imbibing professional knowledge and experience, gradually, in fact, harmonizing theory with practice; we do not attempt to say that he will not also learn much after passing the periods we have named; on the contrary, we say that he undoubtedly will still learn much; the naval education of to-day can never cease; but we do

say that when a Lieutenant reaches three years' seniority, then his individual value, and the value of the system by which he has been trained, can be well and fairly estimated and judged; by that time he should be at least impressed with a sense of his own great and coming responsibility, and his Captain should be able to accurately predict what his future will be, whether he is to be a capable and rising Officer, or the reverse.

Before we carry our argument any further, we admit without hesitation that our present system, faulty or not faulty as it may be, has borne good fruit; we believe that the Officers now comprised on the Lieutenants' list of the Royal Navy are as good or better than at any former period, and we are convinced that they will bear favourable comparison with the Lieutenants of other navies; sailors they may not all be, we are sure that the majority of them are or will be good seamen, and that they possess both the pluck and ability to nobly uphold the honour of their country whensoever they may be called upon to do so.

Having admitted so much, we shall yet have the temerity to suggest certain changes, which have in our opinion become and are daily becoming more necessary.

What we say must of necessity be brief, our allotted space forbids our going more fully into the subject; we are, as we have said before, unable to separate the education necessary to the accomplished use of the ram and torpedo from the general education necessary to make an Officer and seaman; the use of those weapons must be a part and parcel of our whole system, and will contribute to our success in the future as the skilled handling of a vessel under sail did to the achievement of our former naval victories.

In the first place we venture to say that in connection with our text we at present enter our naval cadet too young; if we allowed him to remain at school another two years or so, each lad ought to join the Service with a good mathematical knowledge, indeed we are sure it is better for him to remain at school until he is sixteen, or at least fifteen and a half years old; we are quite at a loss to see why the country should be at the expense of providing the embryo naval Officer in the mathematical and other studies which are necessary in every way, which can be best learnt at school. And we detest the system that places the lad's studies in conflict with and thus diminishes his chance of learning to be a seaman, and in great measure prevents his acquiring anything but a theoretical knowledge of the general minutiae of routine, order, and discipline, that are coexistent with smartness and comfort in every man-of-war.

Let us propose, then, that after a limited competitive examination, we should start our cadet on board the "Britannia" at the youngest between fourteen and fifteen years of age, and thence we would address ourselves to the task of making the lad not only keep up, but advance in what he has already learnt, still devoting much more time than at present to pushing him on in the rudiments of navigation and seamanship, with a fair knowledge of the working of the steam-engine, keeping him here for a year or eighteen months, and, finally,

during the last three months putting him through a course of electricity as applied to torpedo warfare, combined with plenty of instruction in manœuvring boats under steam and sail.

Taking the boy thus later in life will, we think, not only prove an economy to the country but better for the lad, who, we are sure, thrives and physically develops faster at school than afloat; then at the expiration of his eighteen months' course in the "Britannia," a youth at the age of seventeen or perhaps eighteen years is far better able to take his place as an efficient fighting unit in a fighting ship, than he would at an earlier and more tender age; we must not forget the serious reduction that has taken place in the fighting portion of our crews of late years; anything that tends to raise this strength must be of undoubted value; we are greatly handicapped on this head when compared with the navies of other Powers, partly from the fact of our having in some ships so many young midshipmen, and also from the large proportion of the non-combatant element to be found in every vessel.

On our cadet leaving the "Britannia" or College at the age we have mentioned, and on the completion of his course there, we still would not send him in time of peace at once to a fighting ship, but would embark him with his fellows in a corvette for some six or eight months, this vessel to be constantly cruising and visiting foreign ports, practical seamanship and pilotage being his principal studies. At the expiration of this course, the lad being then seventeen or eighteen years of age, should join a seagoing man-of-war for two years, where he should be made of some use and not have his whole day devoted to the study of his books, but to learning practical seamanship, keeping day-watch under the Lieutenant, and gunnery and torpedo work; he should be a close attendant and observer of every evolution and help in all torpedo exercises. At the age of nineteen and a half, provided he had served two years in a seagoing ship, he should be allowed to pass an examination in seamanship, as he now does, before three Captains, this examination to be greatly altered and modified, several of the examination forms being quite twenty-five years behind the times, and no mention being made of the theory or practice of ramming. On his passing, the country must make up its mind to lose the services of its young Officer for nearly two years, during which time he will be fully employed in studying and preparing to pass his four other examinations, viz., navigation, gunnery, pilotage, and torpedo.

We do not like the term "navigation" as it is now understood; to take a first class in it not only means that the Officer who has done so is well up in navigation, but that he has passed in mathematics up to a very high standard; another Officer who may perhaps be equally well up in practical or even theoretical navigation, owing to his inability to become a high class mathematician must be content to receive a second or third class certificate. Now we do not mean to dispute the fact that the man who passes the best examination in mathematics is not perhaps the best man all round as well, but we do say that it is unfair to make a high knowledge of mathematics govern the examination in navigation any more than it does in the other three subjects.

We think that the high standard examination in mathematics should be optional, and confined to those men who compete for five firsts, or that there should be separate subjects, *i.e.*, mathematics and navigation, a moderate knowledge of mathematics being made compulsory in any case.

A Sub-Lieutenant on completing his examination should be hurried to sea at once, and promoted as at present, the class of certificate he has taken being duly considered when the selections are being made.

It will be for the benefit of the Service that a newly promoted Lieutenant should at once go to sea and keep watch for a couple of years, unless he had exhibited any marked aptitude for the special duties of either Gunnery or Torpedo Lieutenant, when one year, but no less, might be sufficient.

At the expiration of two years those Officers who had taken good certificates might be allowed, at the recommendation of their Captains, to volunteer for the duties of Gunnery, Torpedo, or Navigating Lieutenant, and proceed to qualify according to their election.

There should be no half-pay for Lieutenants. Any time between ships should be spent at a naval port in the study of naval tactics, torpedo work, or gunnery.

At each home port constant courses of seagoing gunnery practice, torpedo exercise, and steam evolutions should be perpetually carried on, the latter course will be more useful to the young Officer than half the bookwork he has mastered, much of which he can and does forget, without prejudice to the Service; but if he cannot manœuvre a ship when in action the country will surely suffer. Having once grasped and mastered the art of manœuvring a vessel under steam, all steam tactics, every fleet evolution, and all sea-work generally will tend to keep his hand in.

How few Officers learn how to handle a ship until actually placed in command of one.

How many Captains will be placed *hors de combat* in the first half-hour of a naval battle? It is most necessary that every Lieutenant should have some experience in handling a ship.

We think that we have said enough to make our readers say, how do you propose to give this seagoing training to Officers and men both in seamanship and gunnery, as well as the more advanced course to teach the younger Lieutenants how to manœuvre a ship?

We fully foresee all the difficulties that hamper the question. We foresee the difficulty of finding suitable ships, we foresee the difficulty of finding the money, and we know there are others which we shall not mention.

But to make a beginning, we would abolish the present harbour dépôt ships, we would lodge both Officers and men in barracks. Our harbour dépôt ships are costly to keep up, they have no practical utility for the defence of our harbours, they are guard-ships in name only; the wants of the Navy are so great in proportion to the money voted to keep it efficient, that we cannot afford to keep one useless ship in commission. The Admiral's flag at the home ports should be flown at his own house, or from some serviceable vessel. This vessel

should be often fully manned from the barracks, and make frequent excursions outside the port for gunnery and torpedo work, Officers being sent to her from the gunnery and torpedo instruction ships for this purpose, as well as Officers and men from the barracks.

We would for the benefit of the Service abolish every harbour dépôt ship, steam reserve ship and hulk, those ships that were not seagoing we would at once sell or break up; they now encumber our harbours and eat their heads off.

The work of the steam reserves should be done on shore, all supernumerary Officers and men to be lodged in barracks, where they not only go to wait appointment, but to be constantly drilled, instructed, and exercised.

A seagoing gunnery ship should be attached to both the "Excellent" and "Cambridge;" drafts of men from the barracks should go for short courses of instruction to these ships, where they would at sea fire at moving targets, &c. These two ships might be joined to the Reserve Squadron for its annual cruize, and in combination with torpedo-boats manned from the "Defiance" and "Vernon," night and day torpedo attack might be studied and practised; the gunnery people should be on their mettle to defend their ship, and the torpedo experts to attack them.

We would have no ship in commission that was not efficient and available as a fighting vessel. How much money is yearly spent in repairing, painting, watching, and keeping clean vessels that are absolutely dummies?

To each naval barrack we would attach a good gymnasium; by their use we could impart to our seamen some of the strength, self-confidence, and agility formerly acquired by them from handling sails and spars aloft.

It may be urged that we do not have as a rule sufficient men at the home ports to fill the barracks and keep up the course of drills we now propose. The only reply we can make to such an objection is that we ought to have them. We are not in a position to make war as a great Naval Power if we have not at least 5,000 seamen in hand, either at the home ports or on leave of absence from ships paid off; these men to be embarked before we commenced to draw on the reserves, and should not embrace any young seamen amongst their number, or as few as possible, the younger men to be kept at sea by every means in our power until they have completed five years' service.

We again fully admit all the difficulties in the way of carrying out our proposals, which through limited space we have somewhat abruptly made; but we say that they should always be kept in view as desirable, and that all changes that are made to improve the training of our seamen should tend towards their gradual fulfilment.

It may be asked, why do the dépôt ships deteriorate our young seamen? On all sides it is admitted that they do so; it would appear that the men, knowing that they are only on the roster for draft, think more of the shore than the Service, and being on constant working and dockyard parties become slack and demoralized. In barracks we

think they would do better; it should be firmly stated that they go there for drill and instruction, the time wasted in cleaning and polishing the dépôt ship would be gained.

The Channel and Mediterranean Squadrons are, and would remain, our great training and perfecting schools for both Officers and men; what we propose should be entirely supplementary to them. We submit, however, that for two months in every year each squadron should be principally occupied in offensive and defensive torpedo operations; one month in laying down and picking up submarine mines, defence of harbours, ships, and channels by stationary mines; the other month twenty torpedo-boats, and one or two torpedo-hunters, should be attached to either squadron, who would then be able to practise day and night torpedo attacks and fleet evolutions in conjunction with these fast boats: Officers of all ranks must benefit by such work.

It is a very great mistake to suppose that a Lieutenant taken off the bridge of a large ship, and placed in charge of a swift torpedo-boat, will at first be able to make efficient use of her; not only must he have time to get used to the peculiarities of these boats, their rapid loss of way when stopped, and the quickness with which they acquire a high speed when the engines are started, but he must have time to overcome the strange sense of lowness in the water, to get accustomed to an horizon of only two or three miles instead of eight, and the difficulty thereby of making a landfall, or picking up a ship of which he was in search.

To conduct a flotilla of torpedo-boats to the attack of ships at night is in itself an education; there are fifty wrinkles and dodges that will suggest themselves to the mind of a clever Officer when practised in making such attacks which he would never have dreamt of without. But it is not only in attacks of torpedo-boats that he must be exercised, the defence of ships by a counter-attack is equally necessary, torpedo-boat against torpedo-boat. Here, again, considerable practice in night-work is wanted; without constant practice the strangeness of the dark can never be overcome.

The value of a detached or flying squadron as a means of training Officers and men is undeniable, at present it would seem impossible to form one, the starved state of the Navy provides neither the ships nor the money to keep such a squadron going.¹

While such an important factor in our naval training system is unobtainable, we ought to compensate the Service for its loss, by letting the Admirals on the different foreign stations assemble and exercise their whole squadrons together periodically. The healthy spirit of emulation that arises whenever ships are brought together, and worked against each other, must certainly increase the mutual knowledge of all, to say nothing of the fleet evolutions, signalling, look-out work, torpedo exercise, &c., that cannot well be done except in company with other ships: all would be beneficial.

At each of our gunnery establishments, in addition to the present

¹ We had written this two months prior to the formation of the present Flying Squadron.

very satisfactory course of training that our seamen gunners get, we persistently advocate a more severe course of instruction in firing heavy guns at sea against moving targets; stout well-built targets should be towed at a speed of say seven knots well astern of a gun-boat or tug, the firing ship should pass and re-pass this target at high speeds. It is only in this way that a test can be applied to the value of certain men as captain of a gun or turret. Many men can make good shooting at a fixed target or from a ship steaming at slow speed, but they may utterly fail in taking those quick, almost snap shots at rapidly passing or approaching vessels, which will be so essential to success in future naval battles. With a heavy armament the number of guns in each ship must be limited, probably to four very heavy guns; the loading is slow, the opportunity of seeing the enemy infrequent, but all the same the value of a well-delivered shot is worth now one hundred times its former value, nay more, it may actually decide an action, or determine whether or not a ship be destroyed by swift ram or torpedo-boat. If this be so, can too much training be given to the man in whose power it may be to ensure such results? No, the seaman who as captain of a turret or big gun combines a well-trained hand and eye with nerve and judgment is worth any wages the country can give him, and he will liquidate the cost of his previous training by the accuracy of the first shot that he fires at an enemy.

Constant practice cannot alone give us this valuable specialist, but it will show us the man who is capable, and we should then do our best to perfect him. Very few men will be found up to the required mark; it is not, for instance, given to every one to be a good shot in the sporting field, while to others it is innate, hand and eye work together from the beginning.

These are the days of specialists, our future captains of heavy guns must be specialists.

In addition to the use of a seagoing gunnery ship and towing targets for selecting and training our captains of guns, most valuable instruction could be given in firing quick-firing and machine-guns at rapidly moving targets, while the value of such experience to the Officers who conn the firing ship would be great.

On all occasions opportunities should be seized to exercise in laying guns for rapidly passing objects in all ships. The stationary target is only good for a beginner, otherwise it is a thing of the last decade. With two steamships rushing round and past each other how and when can it be found?

Again we repeat that an extended course of training in seagoing torpedo work is an absolute necessity, not only for the experts, but for all Officers and men of a fleet, it can only be from constant familiarity in their actual use that locomotive torpedoes and submarine mines can be successfully worked either for attack or defence; they all contain a strong element of danger to the careless or unskilled who should strive to operate with them. All preliminary details as to the course of education to be pursued in our torpedo schools we are content to leave without remark in the hands of able

and intelligent Officers who have organized and conducted them with so much success.

The number of Officers who have been put through the course of instruction in our present torpedo schools, both on full and half-pay, speaks well for their future, and the further requirements of the Navy, as regards this highly scientific branch of modern warfare, may with safety be left in the competent hands who preside over them.

We in England are not, however, alone in our efforts to instruct and educate our naval Officers and seamen in the use of the torpedo and submarine mine; nearly every civilized Power has its torpedo school, and the Russians with their exceedingly limited naval responsibilities have not alone torpedo schools, but they educate their naval Officers in the use of the ram. Gunboats protected by fascines have been manœuvred one against the other, and we are sure that such a plan must give much instruction to the Officers who conduct the manœuvres, as well as to those who conn the opposing gun-boats. Russia has also had considerable practice in the use of torpedoes in actual war; they were not, however, very successful with their Baltic mines in 1854 and 1855, which were of a very primitive nature, and of a purely mechanical type. Later, in their Black Sea defences against the Turkish Fleet, they had some successes both with the spar torpedo and the submarine mine; these successes appear to have much stimulated their Officers, who now eagerly pursue the study of torpedo warfare, and appear to indulge in the hope that they may eventually by these means distinguish themselves, and trust that they may baffle the greater naval resources of other countries, that is, should the political necessities of the day again make it necessary for them to defend the coasts of the Baltic and Black Sea.

France, the United States, Italy, Austria, Denmark, Sweden, &c., all have their torpedo schools, and with one or two exceptions have each conducted important and interesting experiments in the use of the submarine mine. In France they have gone so far as to actually destroy a vessel towed at a speed of seven or eight knots by boats armed with the spar torpedo for practice and experiment. They have further put this practice to good use by quite recently destroying two Chinese men-of-war by the same agency. It is believed that the *défense fixe* of their principal seaports has been very successfully organized, and that a complete system of submarine mines are kept ready for submerging by Officers and men well trained to their use.

The United States have never forgotten for a moment the trouble and loss they encountered from the Confederate torpedoes and submarine mines; accordingly they have established a very well-conducted and superior torpedo school at Newport, Rhode Island. There every facility is given for conducting the most scientific electrical experiments, some of which are of so delicate a nature as to be impracticable in the damp atmosphere of a ship. We do not actually advocate a shore-going torpedo school because we mention this, but we think it as well to take note of it, and on the other hand set against it, that our Officers who are taught in a ship will practise in actual war under the same conditions and under the same disadvantages as they in-

herently contended with during their course of torpedo instruction afloat.

It is a significant fact well worthy of attention as regards the high estimation in which the American nation hold the future of torpedo warfare, that while their Navy is kept in a very low condition and is in many ways starved through the low estimates annually voted by Congress, yet that they have taken equal if not greater trouble to instruct their Officers and seamen in this new branch of naval warfare than some other nations who yearly spend enormous sums on the maintenance of their fleets.

We advocate for consideration whether all our engineer Officers should not be instructed in practical electricity, and further that they should have the opportunity of voluntarily becoming trained torpedoists. We also do not think that it is necessary to confine the Warrant Officers torpedoists to gunners alone, we think that a proportion of the younger boatswains might with advantage to the Service be allowed to become torpedo Warrant Officers. In the event of a heavy naval war, the strain on the number of Officers and Warrant Officers specially trained as torpedoists is sure to be very great; we do not think the number at present so qualified is by any means adequate. Our own idea is that in the event of war we ought at least to be able to at once man 300 torpedo-boats. with a large proportion of torpedo-cruizers and torpedo-hunters, this number to be entirely independent of the torpedo-boats carried by our large ships, and the steam pinnaces and cutters of the smaller vessels.

To get the full value out of such a flotilla in time of war, it is necessary that the Officers who man them should be familiar with the inside of the enemy's ports and harbours; a most valuable course of instruction would be to send a number of Officers yearly to visit and privately report on the approaches and defences of the principal foreign seaports, inlets, &c.

We cannot end our remarks on this part of our subject without a word of acknowledgment concerning the great instruction we have personally derived on many professional matters by a constant study of the "Journal of the Royal United Service Institution." Much of our essay is necessarily based on the matter contained in some of the valuable papers that have been read in its theatre, and also from the discussions that followed them. It would be quite unfair on our side if we did not embrace the present opportunity to make this admission, as it also would be if we failed to make some allusion to those great benefits which such an Institution confers on the Naval Service, by collecting and promulgating so much valuable knowledge, the constant dissemination of which must very largely influence the theoretical training of our naval personnel.

CHAPTER VI.—*Construction and Protection of Matériel.*

Before the era of armour-plated vessels, it was quite possible for a naval architect to assume, and perhaps not unreasonably, that in some newly constructed ship of his own designing he had achieved almost perfection.¹

Undoubtedly, some of our line-of-battle ships were, in respect to the way in which they responded to all that was required of them, the acme of perfection as ships of war. But how widely different is the case now! the manifold demands of modern naval war make it a *sine quâ non* that every effort that is made by the naval architect towards the attainment of perfection on any one particular point in a modern battle-ship, by so much must he fail in some other special feature, which, if referred to professional opinion, would be pronounced an equal if not a greater necessity.

Let us briefly enumerate and examine a few of these special points which are necessary to the fighting efficiency of the battle-ship of to-day, many of which are the result of the introduction of the ram and the torpedo as naval weapons.

The naval architect of to-day who would design a perfect battle-ship must adopt fine lines and secure a good speed, he must keep the proportion that the length bears to the breadth of his ship well in hand so that he may ensure good manœuvring power, he must take care that his vessel is able to carry a sufficiency of coal and stores, he must protect her machinery and most vital parts with armour of immense thickness, with all this weight he must have engines strong enough to propel her swiftly, and mount at least four very heavy and a fair proportion of lighter guns with the requisite supplies of ammunition and stores for them; his creation must be capable of being used as a powerful ram, she must have a powerful instalment of the Whitehead torpedo, and she must be to a moderate extent secure against the attacks of the ram and of torpedoes; above all she must be seaworthy, have a steady gun platform, and be fairly commodious for both Officers and men.

All these conditions, many of which are in actual contradiction to each other, cannot be reconciled; for instance, what is put on in armour must be taken away from the weight otherwise carried, either from the machinery, guns, or coals; if the ship is built with a bluff bow and a full midship section, she will either be slow or require an equivalent increase in coals and engine power; if she has fine lines to get speed she will not carry her weight, and so on *ad infinitum*: we can only get relief in one way, *i.e.*, by omitting all use of sail power we free the naval architect from one of the many irksome and conflicting conditions by reason of which his designs are restricted and trammelled.

No wonder that we find our naval constructors producing ships so widely different from each other, no wonder that we find them dabbings on strips and patches of armour in one place in some ships, in just the opposite in others; pressed to a great extent by the varying wave of public opinion, what is considered the safety of one vessel is the danger of another. In certain vessels the guns at all costs must be protected, in others it is not the guns and the men who will have to fight them that want protection, but the water-line; while in the very last class of vessels, it is considered best to let the enemies' shot and shell pass if they hit clean through the water-line for two-thirds of the ship's length, protecting with vertical armour only an absurdly

small part of the ship's centre, and placing therein all that is vital, keeping the water that must flow freely in to either end through shot holes or shell chasms from going below by means of a strongly armoured deck. But enough: it is easy for us to quibble, we are fortunately not naval architects; still we write as we do to show the dilemma that exists, as well as to indicate that if aught we should say reflects upon the directors of our naval constructive policy, yet that we are fully sensible of the great and exceeding difficulties of their task.

For a moment only let us suppose that our naval architects are perfect and have reached that happy and impossible state in which they are fully competent to design a perfect battle-ship, and that they have so evenly balanced all the necessary but conflicting conditions, such as speed, protection, &c., in some particular vessel of not unwieldy dimensions, so much so, that for once hostile criticism is disarmed and powerless; but even then they will fail, for given perfection in a vessel of a certain size, we at once leave matters of detail and enter the question of dimensions, when it will be found that a larger vessel can always be built which will be much more powerful; then we may say that the skill of the architect being perfect, the powers of each ship will vary with her actual weight or displacement, we may positively state that increased displacement should give increased power.

This cannot be gainsaid; but as to the consequences of increased size, where is to be the limit? Do not the necessities of modern naval war most positively forbid that we should throw our whole constructive strength into the creation of the biggest possible ships? Each monster ship being, as we shall show, equally liable to fall a victim to the ram or torpedo, it would be a fatal error to build big ships alone. But we do say, and that vigorously, that it would be most imprudent for us as a wealthy maritime nation to allow other nations, who are naturally less maritime than ourselves, to outdo us in the creation of these large ships of unequalled powers: no, we should create ship for ship with them, lamenting the necessity for such large expenditure but fully recognizing the imperative force of it, being fairly content to equal or moderately surpass our rivals for the supremacy of the seas; in the construction of these monster vessels we should still better take care not to limit our efforts to their construction alone, but be sure of having a largely preponderating force of what we might denominate second-class armour-clads, which, while they were less costly, would take a good place in the columns of our future fleets.

We venture to think, not however without considerable diffidence, that our recent shipbuilding policy has not been altogether successful; it is true that in one or two vessels we may have excelled, and for a time have outstripped the other Powers who compete with us, but in the main, and we say it with all humility, the result is not altogether satisfactory.

We do not mean our essay to be in any way a critical attack, far from it, but simply wish to express our own views as a seaman, happy if our thoughts, should they be made prominent by the award of the

referees, can add one atom towards our naval strength in the future; happier still if aught that we say as to the inefficiency of our war-ships can be promptly and authoritatively denounced as incorrect.

We know that the first application of armour-plating was to keep out the shells, without it our wooden-built ships were, on going into action, nothing but the material for huge bonfires, this was well understood long before the introduction of armour-clads; but the actual necessity of having plates to keep out shells was not practically illustrated and endorsed until Sinope, and again, their value was not tested and approved until still later, during the attack on Kinburn. The result of this action and the impunity with which the hastily-constructed floating batteries of the French under a hailstorm of shot and shell attacked the Russian forts, induced the Emperor Napoleon III to sanction the construction of "La Gloire" in 1859, and we followed quickly with our "Warrior," "Black Prince," &c.; since then the contest between guns and plates has been almost universal and perpetual, and it is likely to continue. Even in the presence of the ram and the torpedo, we feel that it is necessary to discuss the armour and gun question; the former have not yet succeeded in exterminating the latter, for the ram itself, to say nothing of the locomotive torpedo, may be looked upon as the natural outcome of the desire to easily destroy a powerful heavily armed and armoured vessel; it would be folly to suppose (if the locomotive torpedo did not exist) that in the ordinary course of naval war, the well-armoured and well-armed ship would not be able to destroy all unarmoured vessels whom she can equal or surpass in speed; we consider that quick-firing and machine-guns will give a strong impetus to the retention of even a moderate thickness of armour.

The contest between guns and armour which, as we have said, has been perpetual for the last quarter of a century, has as far as the navies of England and France are concerned now assumed a very eventful stage; the ideas of both nations are running, if we may judge by their most recently constructed battle-ships, on the same lines, but on strangely differing principles; both have agreed to increase the strength and thickness of the armour by limiting its application. While we have retained vertical armour on the citadel only, trusting to an armoured deck to give safety to some two-thirds of the length of our new ships, the French have meanwhile still adhered to the armoured belt, very much narrowed in its vertical height, but extending the whole length of the water-line. We find ourselves represented by vessels of the "Inflexible," "Colossus," and "Collingwood" types; and we see the French represented by the "Amiral Duperré," "Baudin," &c. If our system be right, we may be very well satisfied with ourselves; if it be wrong, we are truly in a dangerous predicament; and we are nationally very much in need of some forbearance on the part of a neighbour who does not enjoy a very stable Government, and whose interests at present are liable to clash and conflict with our own in nearly every part of the globe.

Here we feel that it is necessary for us to pause a moment and justify ourselves once again for apparently taking our subject beyond

its proper limits; but we say that if a ship be liable to be (through defective construction or through not being built on sound principles) waterlogged by gun-fire, she must then fall an easy victim to the ram or to the torpedo, and hence by inference fall within the scope of our labours; in any case the matter is one of national importance and cannot well receive too much attention.

The ends of all our latest armour-clads of which, in addition to the "Inflexible," we shall soon have ten, are entirely unprotected as far as vertical armour is concerned; but a stout armoured deck rises from their sides some six feet below their water-line up to or above that level amidships, and sloping down forwards to the point of the ram. This deck is both shot and bomb proof, and very materially contributes to the strength of the ship. While the ends of these ships above the armoured deck have been purposely constructed of thin plating to let almost any description of shot and shell through, all sorts of ingenious plans have been arranged to reduce the influx of water due to such damage; there are many subdivisions over the deck, coffer-dams, stowage of coal, filling in with cork, &c.

This method of construction has its own merits, *provided*—we would emphasize the word *provided*—the citadel is so thick that it is impenetrable by the guns of an enemy, and also that the guns fired from it are so powerful as to be sure, if they hit, of smashing a large hole in the water-line belt of the enemy; if the "Collingwood" were thus situate as regards the "Amiral Duperré," we might on paper at least safely award her the victory.

But on a close examination a different result appears more than probable: it seems that the "Amiral Duperré" will nearly equal the "Collingwood" in the power of her big guns and surpass her in the matter of small guns, that her big guns will be distributed in four towers instead of two; it is true that they are not so well protected as those of the "Collingwood," but there are four towers instead of two to disable; in the matter of central protection we will allow both ships to be equal, but for two-thirds her length the "Collingwood" must let every shot or shell of the enemy pass in at one side and out at the other, and it is possible, nay, even probable, that large shell may strip off yards of this thin plating at a time, and that any part can be riddled by Hotchkiss bullets.

We acknowledge the "Collingwood" to be a grand ship; her speed and coal supply are excellent, she carries ammunition and stores largely in excess of her rival, and we are convinced that she would make a far better fight than some of her critics are disposed to admit; but if during the first hour of a combat with a ship like the "Amiral Duperré" she were liable, as we believe she is, to have one or both of her ends waterlogged before either her ram or torpedoes have been successfully used, then there is no need to follow the result much farther; if speed or steering power be affected seriously the battle is lost, the ram or the torpedo will quickly complete the destruction that was commenced by the gun. Before quitting this part of our subject we think it is worth contemplating what would be the effect of severe injury to the unprotected stem of the "Collingwood" above the

armoured deck; she already at full speed carries a high bow-wave, what if this wave was poured by reason of the ship's velocity into a chasm at the bow! Where could the water so heaped up and pressed in, escape, what could withstand such hydraulic pressure? We fear the result would be most disastrous.

N.B.—If the compressed cellulose cocoanut-fibre which has recently been tried in France, and which, by swelling rapidly the moment it is wetted closes up any hole made through it most effectually, be found to be a definite success, its employment will add enormously to the strength and fighting powers of our new ships with unarmoured ends.

Enough has been said to show that, in the presence of light quick-firing and machine-guns, it is well to have protection at the water-line; even a narrow vertical steel belt of three, or even two inches, would stop all light and deflect many heavy projectiles.

We do not like barbette towers; in spite of their greater weight we prefer revolving turrets; it has to be acknowledged that the return smoke from heavy breech-loaders will be highly inconvenient in a turret, this is a difficulty that can be got over; either barbette or turret is, however, infinitely preferable to placing a heavy gun in a narrow port with a limited training of only a few degrees; it is quite as bad as putting a light under a bushel. We have heard people say let the ship train the gun: we say on the contrary and most decidedly, let the gun have as much training as possible independently of the ship, and let the ship have the advantage of manœuvring independently of the gun. The Captain of a ship in action will have often quite enough to do to avoid the ram or the torpedo of his enemy, and at the same time seek to use his own similar weapons should a weak turn on the part of his antagonist give him the chance, without his being bothered and tortured with the additional effort to keep his guns bearing. The gunnery advantage in a single action will lie with that ship whose guns are so well arranged that a part of them will always bear on the foe. Let a Captain if he so wills it train those of his guns that have a very limited training on a given bearing and fire them electrically as they are brought to bear; but if he has to fidget so as to constantly nurse a broadside of guns to keep them bearing on the enemy, he is as likely as not to get his ship rammed or struck by a Whitehead torpedo.

Although stability at large angles of heel is now unnecessary to render our battle-ships safe to carry sail, yet it is still a necessary quantity among those stubborn and conflicting forces which the naval architect of our day has to reconcile. The ram and the torpedo make it an absolute condition of safety in action that a ship should have a fair reserve of stability and a large surplus of buoyancy.

To obtain this, the weights must be kept fairly low in the vessel, and the freeboard must be made at least moderately high.

When we were alone confronted with the undiluted question of guns *v.* plates, a low freeboard was such an evident and palpable advantage from a fighting point of view that we may not unreasonably assume that its attainment mainly led to the loss of the unfortunate

“Captain” and her gallant Officers and crew; her sad catastrophe, followed as it was by the abolition of heavily-rigged battle-ships, and the construction of powerful sailless turret-ships of low freeboard, has in a very short interval taken us from the Scylla of capsizing under sail to the Charybdis of turning turtle in action from injuries sustained by the ram, the torpedo, or the submarine mines of an enemy.

There can be little doubt existing in the minds of those of us who have applied ourselves to the question, that in the future the two former weapons must take the most prominent places in large naval battles, and the damages and injuries they will inflict will never be above but always below the water; the battering fire from guns, if we except those chance shots which happen to strike at or below the water-line, will seldom or ever affect either the flotation or the stability of an armoured vessel, but on the contrary every blow of the ram or shock from the exploded torpedo must in every case at once directly influence and affect these vital qualities.

Indeed, we may say that in any vessel not well endowed with surplus buoyancy, or which has not a respectable stability, the very safeguards on which she relies to save her from rapid sinking if struck by ram or torpedo contain in themselves a formidable element of danger. In these days of central divisions, fore and aft bulk-heads, huge wing passages, and spacious double bottoms, what is to become of that vessel that has had several hundred tons of water run in on one side of her, and whose low freeboard gives her a vanishing stability at a small angle of heel? The steady platform that it may previously have afforded can be no compensation in such a case.

It is self-evident that the ram and the locomotive torpedo demand that a fair measure of stability be given to all war-ships, and that the low freeboard be abolished.

The spectacle that would be exhibited by many of the large war-vessels of the present day after the first hour of a closely-contested fleet action would be, but for its dreadful sublimity, absolutely ridiculous. In the older days after a hard-fought fight the battle-ships of the combatant fleets floated proudly upright to the last; they might be indeed dismasted and helpless, or on fire, but even then they floated grandly until their magazine exploded; or they might settle slowly and sullenly to the bottom through their pumps being unable to clear the ship of water, but they were fairly stable until their very last moments had come. But now let us picture to ourselves the spectacle which the survivors of a fleet action would show us; some ships will have bodily turned turtle, and gone to the bottom like a pig of ballast; we shall not of course see them, but we shall see others lying over bodily on one side in imminent danger of doing the same thing; some few will have their bows deeply immersed in the waves with their propellers wildly revolving in mid-air. Others in a better plight may have their rams pointing to the skies, or be in the condition of a half-tide rock with their deck freely swept by every wave. On such an occasion the victors will hardly be able to comfort themselves with an air of triumph; the defeated would require nothing to add to their dejected appearance.

It is evident that the efficient arrangement and distribution of guns bears strongly for or against a successful attack by the ram or the torpedo. The larger arc and field of training that the skill of the naval architect can give not only to the individual but the whole of the guns of any ship, so much the more efficient must she be, not alone on this particular point, when she is called on to match her guns against the guns of an opponent, but in the free and unrestricted use of the two weapons which it is more especially our duty to discuss in this essay.

In the same sense we may here appropriately argue that the Whitehead torpedo already demands that when it is installed in any ship the points from which it is discharged shall not be limited to one or two directions; right astern and bow and quarter discharges are almost, if not quite, as necessary as a right ahead or abeam installation.

We have personally long been of the opinion that the small craft of the French Navy were superior to our own on the first-mentioned point, most of their guns being mounted so as to have a large training field; their chief defect being that the gun was too much exposed. This will tell greatly against them now that machine-gun fire is of so much importance. The corvettes and larger gunboats of the French have been greatly superior to ours in speed; though carrying a lighter armament than the corresponding vessels of our Service, also having a lighter rig, they were much better suited for look-out service and cruising work than our craft, who would, should occasion have required it, stood no chance of catching them. We deplore the miserable craft that we call sloops, they can neither sail nor steam, they do to show the flag to some disadvantage in distant ports, and they carry a fair armament; but their miserably slow speed renders them useless for war, when they would have to stow themselves away in some neutral port and transfer their crews to a fast cruiser or armed merchant steamer.

We have had of late plenty of opportunity for observation, and we say positively that our present sloops and gun-vessels are totally unable to overtake the most ordinary merchant steamer if she chooses to make them chase her head to wind.

Our gunboats and gun-vessels are nearly in the same category, but they may be of some service up rivers, or in narrow waters, and the newer ones steam rather better than the old ones, especially better than the old double-screw makeshifts, which were constructed mainly with the view to utilize old engines.

To construct sloops and gunboats that will be of some use in a modern naval war, we must abandon the absurd amount of beam that we give in proportion to length, and give up the idea of making a compromise between steam and sails; we do not want a vessel to sail well in time of war, but she must steam well or she is useless, more especially so for ramming or torpedo work.

There are so few frigates that it is hardly worth while to notice their existence in our essay; fast sloops and belted cruisers will take their place in the naval wars of the future, those we have should be

fitted to act as rams, and be well fitted to discharge Whitehead torpedoes. It would be the extreme of folly to expect an unarmoured ship to attack an armoured ship by day; but at night the inequality due to protective plating would be less, and the unarmoured ship might successfully use, by reason of superior speed, either the ram or the torpedo.

The construction of torpedo-hunters and scouts must form a very important item in all naval estimates of the future, fast vessels of light draught, fair seagoing qualities, and armed with quick-firing guns will not alone prove of the greatest value in destroying the torpedo-boats of an enemy; but they will also from their ability to accompany a fleet, and their armament of Whitehead torpedoes, prove themselves valuable allies to armour-clads, even in line-of-battle. Such vessels should have a speed of 18 knots, and a tonnage displacement of from 400 to 600 tons; they will be expensive to construct, as the materials of which they are built must be of the best mild steel, as light and strong as it can be got, and the engines must for their weight develop a very high horse-power. No armour or plating will be possible except perhaps a shield for each quick-firing gun, a curved deck over the boilers, and a light protection for the Captain and for the steering wheel.

We look upon the much-abused "Polyphemus" as a decided success; she would no doubt be much improved if some of her most venturesome peculiarities could be left out, such as the dropping weight, &c., but with all this we are sure that she would be of great service in a fleet battle, and she is eminently well fitted to run amuck at night through an enemy's squadron; she would also be an immense assistance to any fleet in helping to beat off a torpedo-boat attack. We do not by any means think that she will be the last of her class.

The half dozen torpedo-cruisers now under construction for the Royal Navy have been begun not a day too soon. They promise to take a valuable place in our war fleet, and their absence, if we had to make war without them, would be much felt. We think they are too large and costly to be employed in watching ports containing ordinary first class torpedo-boats, and their draught of water will not exempt them from occasionally falling victims to night attacks from Whiteheads, but by day in any seaway their high speed will make them the terror of most torpedo-boats,¹ and they will be a great safeguard to a blockading or cruising fleet.

We look to torpedo-boats for most of the hard work and fighting in the next naval war; for night attacks, night defence, for all the old cutting-out work, torpedo-boats will be employed. Let us note the avidity with which certain foreign Powers have seized on the idea of employing them, rejoicing in the thought that torpedo warfare may level the power of all maritime nations. Some foreign writers have gone so far as to openly exult in the thought that they may so nullify our naval supremacy. The most important of the European nations already possess more torpedo-boats than we do, and compared with

¹ We think they are hardly fast enough to catch torpedo-boats in smooth water.

their requirements they certainly seem to have stolen a march upon us, both in the number of the boats and the pains they take by attaching them to their fleets, and otherwise exercising them, to ensure to ensure their efficiency.

French torpedo-boats have recently in actual war destroyed with the spar torpedo two Chinese men-of-war, and just before the conclusion of their peace with China several first class boats were sent out to their China squadron.

The Italian squadron which was sent down the Red Sea this spring was accompanied by six thoroughly well-found and equipped torpedo-boats of the first class.

It is the opinion of the French that they will peculiarly benefit by the construction and employment of torpedo-boats; their geographical position allows them by virtue of their railways and canals to concentrate at will their torpedo-boat force, either in the Channel, Bay of Biscay, or Mediterranean, and their newly-acquired territory of Tunis, to say nothing of Algeria, abounds in small harbours very suitable to shelter torpedo-vessels; these ports command nearly the whole of our trade route between Malta and Gibraltar.

It has been very recently proposed by a French writer who is well versed in naval matters to supplement the *défense fixé* of their five principal naval war ports or arsenals by distributing 75 torpedo-boats amongst them as follows as a *défense mobile*:—At Cherbourg, 20; Toulon, 20; Brest, 15; Rochefort and L'Orient, 10 each. All these boats are, as we have said, capable of concentration at one port, but our writer is not satisfied with such a force. He further argues that no time should be lost in providing 100 torpedo-boats for the defence of colonial ports, 100 for the formation of an active torpedo cruising fleet in the Channel, Mediterranean, &c.

If France is willing to construct such vast numbers of these boats, it is no time for us to linger over their rapid construction. Fortunately for us, private enterprise has placed us in a position to rapidly obtain from well-established firms a number of torpedo-boats of the best quality and construction, without putting any strain whatever on our public dockyards.

The construction of these fragile but swift craft requires workmen of the greatest skill and ability, not only for their hulls but for their machinery. We say again that it is fortunate for us a nation that we have at least two reliable firms to construct these vessels for us; but good as the Thornycroft and Yarrow boats are, they are run close if not beaten by Messrs. Normand in France, and we believe that the Germans have also been successful in constructing fast boats for themselves.

It will probably take from nine months to a year to complete the construction of a first class torpedo-boat, from the date of the order to the trial trip, so we may be sure that it is unwise to leave the order for their construction until the day when we are suddenly involved in a maritime war; it is true that this is only one-third of the time required to construct an armour-clad vessel, and that to the amount of this difference of time our country is clearly the gainer, for with our

resources we could launch ten boats to one launched by other countries in the same time; but even three months might in these days of rapid but costly wars be fatal to our maritime supremacy, that is if we were left for that space of time unprepared and without a sufficiency of torpedo-boats.

Steamers of the "Hecla" class fitted to carry torpedoes, torpedo-gear, and a large proportion of submarine mines, with a fair proportion of torpedo-boats, are most necessary. They should not only accompany a squadron, but be detached to harass the ports and harbours of a blockading enemy; but we do not think it is necessary that these vessels should be constructed in the Royal Dockyards; efficient merchant steamers can be purchased very suitable for such work. These should be bought, then altered and otherwise fitted for the work they will have to do. They must primarily be vessels of good speed, for we may be sure that an active enemy would leave no stone unturned to destroy vessels of this class with their valuable cargo of second class torpedo-boats and torpedo stores. We think that our Navy should at least possess three vessels, improved "Hecla's," no matter whether bought or constructed.

It has been well proved in our large armour-clad turret-ships that mast and sail power can be advantageously dispensed with; but although masts are not necessary to spread sail on, they are by no means useless; on the contrary, one or two stout military masts on which to mount machine-guns are actually demanded. Guns so placed will be most useful in action to keep down the machine-gun fire of an enemy, and to pick off any people who may be exposed on his decks or hull; military masts are besides useful in obtaining the range, and from their tops being above the smoke they will often be the only place whence a view of the enemy can be got; also we must not forget the importance to an armour-clad vessel of commanding a large horizon; when we reflect that they are exposed to the attack of boats that can travel at a speed of 20 knots, we cannot help admitting that a wide range of vision and a sharp look-out from aloft are things not to be despised. Hence it seems that every large ship should be constructed to at least carry one military mast with a long topmast, fitted with a crow's nest for the look-out man. We do not see any good reason why these military masts should not have two tops or platforms fitted to them, the upper one in the usual place and the other beneath it, just high enough to be clear of the smoke of the funnel; the situation would be commanding, and in our barbette and turret-ships it is not easy to find the requisite places to mount all the machine and quick-firing guns that are needful.

Any fleet on detached service would require to be accompanied by a factory steamer, capable of rapidly repairing torpedo-boats, and with appliances on board for the speedy repair of heavy machinery. The services of such a vessel would be in these days constantly in requisition; we doubt whether it is wise to postpone the construction or fitment of such vessels until we are involved in a maritime war.

Special hospital ships are also a necessity, but these can fortunately

be utilized very rapidly from amongst the largest of our noble merchant steamers.

A factory steamer, wherein large repairs to machinery and plates could be carried out, must follow closely on the heels of every considerable assemblage of war-vessels; such a vessel should be capable of hoisting in and repairing a first class torpedo-boat.

CHAPTER VII.—*Attack and Defence of Ships : Fleet Attacks.*

The conditions now existing under which either ships singly, or combined as squadrons or fleets, will attack each other, or defend themselves from attack as opportunity or occasion may require, are so vastly different from all previous experience as recorded in our naval history, that it requires the exercise of some courage to prophesy what the naval tactics of the future will be; nevertheless the great diversity of opinion which now exists on most naval matters renders it at least easy to predict, however rash our assumption may be, that we are yet sure to witness some very startling surprises, whensoever the next war between two really strong naval Powers may occur. Meantime we would not ignore the fact, that the wars which have occurred during the last quarter of a century have given us some very valuable data, or attempt to deny that from their issues some useful lessons have not been learned; but none of these wars have been a stern contest for the supremacy of the seas, such as our forefathers fought so well, and such as we ourselves may have to fight at no very distant date. In most of the recent wars one of the contending nations has usually commanded a preponderating naval force, and in others, we say it without levity, it has been merely playing at naval war; the stern courage, the equality of forces, the intense reality of our old sea fights, of Trafalgar, of the Nile, of Lord Howe's victory, have all been wanting. Enough, however, has been done to let us take a fair measure of the employment of shell fire, of protective armour, and of the destructive effects of the ram, the torpedo, and the submarine mine, as well as the extreme alteration of naval tactics that will be *volens nolens* forced upon us in the future.

As we have already said, the omnipotence of the battle-ship has departed, her immense powers of fight are liable to be often nullified or rendered useless in the presence of (as far as size and cost is concerned) well nigh contemptible antagonists; it is indeed by no means certain whether in a few years' time these monster battle-ships, as we now know them, will even be in existence; but it is sufficient for our present purpose that they do exist, and that in spite of a strong foreboding to the contrary we do not dare to say that their presence could be dispensed with, or that we could find any sufficient substitute for them, wherewith to awe our enemies and protect our shores and commerce; indeed we go further, and do not hesitate to repeat that as long as other nations persist in constructing these costly battle-ships, so must we, regardless of cost, continue to do so; with our present limited experience, it would be the rankest gambling if we discontinued their construction. It appears to us that as matters now

stand, the armoured battle-ships must be regarded as the nucleus on which to form a hybrid fleet of swift rams and swifter torpedo-vessels. And we venture to assert, to the full extent of the force of which our feeble pen is capable, that without being strongly supplemented by such craft, any armoured fleet, however well found it was in itself, must in the presence of an active enemy have nothing but a hard time of it. In a few words the long and short of the matter is, that it is necessary to have a fleet of battle-ships to face the battle-ships of the enemy; such ships, when naval supremacy has been ensured, to be used to bombard and attack towns and seaports; but that in the first instance it would be a foolhardy proceeding to expose such ships wantonly and unsupplemented to the attack of smaller and swifter vessels which were fitted as rams or torpedo-vessels.

The attacks of swift torpedo-vessels may be made so insidiously, either by day or by night, or during thick weather, that they can only be successfully combated or baffled by the employment of similar or special vessels purposely armed to destroy them. Thus it may be accepted as a positive axiom that it is and will be necessary to destroy torpedo-vessels with vessels designed to destroy torpedo-vessels, to fight small and swift rams with small and swift rams, to seek and destroy the swift cruiser with swift cruiser, and that all these vessels, while scouting or skirmishing around and in the vicinity of armoured fleets, will have constant encounters with each other; and finally, on two armoured fleets deciding to submit their destiny to the fate of an action, that then, in the dire smoke and confusion that will follow, leading up as it will to the awfully mad *mêlée* which must inevitably result before the battle is lost or won, then we say that at this supreme moment these small and swift vessels are destined to take no mean part in the victory or defeat of the day.

The fleet which can make use of a preponderating force of such craft should, other things being equal, have the advantage over its adversary.

Among these other things upon whose equality we have somewhat lightly dwelt, high speed, as we shall hope to show further on, will be an immense advantage, indeed the seagoing attack of torpedo-vessels hinges entirely on high speed.

In the presence of an enemy, the successful manœuvres of a fleet will depend on a high speed; two or three very slow ships are better out of it, they will only encumber the rapid manœuvres of the whole.

The collective speed of a squadron or fleet before going into action must be limited to the speed of its slowest ship. In keeping correct station it is necessary that all ships except the leader should have a small reserve of speed in hand. Few evolutions can be carried out without reducing the progressive speed of a fleet some three knots below the speed of its slowest ships. The presence of one or two slow ships in a fleet, whose services were actually necessary to bring its numerical strength up to the level of that of the enemy, would be an unmitigated nuisance to the Admiral in command. It is most probable that the divisions of a fleet, and their subdivisions, will each

have their ships selected so as to ensure, as much as possible, an equality of speed; great advantages can thus be derived in the way of maintaining the speed of the fleet, by in all evolutions assigning the most work to the fastest division or subdivisions; we shall say more on this head in a future chapter.

The very complete transition of sail power into steam power, at which we have now arrived, has eliminated all the uncertainties which in the old days were due to wind and weather; the movements of the larger vessels of two hostile fleets are rendered with small exception as certain and absolutely controllable as the movements of two squadrons of hostile cavalry, more so indeed, for on the open sea there are no fences, walls, obstacles, or rough ground to embarrass or confuse one or other of the combatants.

Let us a little further on endeavour in imagination to depict a fleet battle of the future, and in a few words only demonstrate the tactical value of the fighting quantities that can be contained in each of the units that will compose a modern fleet.

In the first place we assert that it will be most important that a fleet should not be allowed to blunder unexpectedly into sight of the enemy's fleet; a fleet surprised is taken at a most decided disadvantage; for instance, we will suppose that for the sake of husbanding fuel the fires are low; on sighting the enemy on the horizon, steam for full speed will be the first order given; again, supposing the weather to be fine, torpedo-boats must be got out or lowered, and the ships cleared for action: what time will be given to do all this? Two vessels proceeding at 10 knots in opposite directions meet in twenty minutes from the horizon; in any case from twenty to forty minutes will be the longest time allowed for preparation. Is the unready fleet to turn and by a temporary retreat evade the rapid approach of the other, and thus gain time? This would appear to be the only plan. Yet, would it not look suspiciously like fear, and a direct invitation to the enemy to come on boldly to the attack? There can only be one answer to this.

Certainly then it will be of the highest importance to prevent a surprise, even on the high seas; but for a fleet to be surprised at anchor, simply means a repetition of Sinope; the ram and the torpedo, however, will do the work of the Russian shells on the occasion of that massacre. We do not suppose for a moment that a fleet of ours will ever be surprised in this way, but it is necessary for our argument to show the danger of it.

To prevent a surprise it will be necessary both at sea and at anchor to have the approaches to the fleet guarded by fast look-out ships, or vedettes, extended some 10 or 12 miles, keeping touch of each other, and being extremely vigilant and jealous of all approaching vessels, stopping and boarding all strangers, and passing on by signal any information that may be obtained. A strong force of these vessels should precede the course of a fleet, and a lesser number should extend on both beams and astern of it: could armoured vessels do this work for themselves? No, most certainly not; goodness knows they are short-winded enough as it is, their bunkers would soon be

empty if they were thus employed ; there are indeed no frigates and few corvettes in our Service that are equal to it ; the only vessels that we know which could do it well would be our fast armed merchant steamers ; their high speed, great coal capacity, especially so if coal were stowed in place of cargo, render these vessels of unequalled endurance as scouts or cruizers ; there should be no fighting for them here, speedy information is all that is required. Our new torpedo-cruizers, such as the "Scout" and "Mohawk," promise to be well fitted for this work ; the "Mercury" has since proved her ability.

In very fine weather, or in narrow waters, torpedo-boats of the larger class could be utilized as vedettes, but they are very low in the water, and can see no distance, besides being short-winded if hard pressed. Their more proper function would be to lie close to the fleet, under easy steam, and in constant readiness for work. In our opinion, wrong though it may be, our present first class torpedo-boats are incapable of being constantly kept with a fleet,¹ they may do so for a short run, in and out of a port, but otherwise the wear and tear on not alone the boats, but on their Officers and men, would be too great. They are, however, well fitted indeed for issuing from a harbour for a night attack ; for sending inshore of the fleet to reconnoitre ; or to support their fleet in an action during fine weather, but as regards a really seagoing independent existence they are quite incapable.

A much larger and more powerful class of vessel is needed, and will have to be built by all those nations who aspire to the possession of an efficient navy.

The naval Power which can first create a large force of fairly seagoing torpedo-vessels, of high speed, which are capable let us say of keeping the sea for a week independently and on their own resources, will have largely augmented its naval strength.

Having hastily discussed their probable composition and organization, we will now, for the sake of illustrating our arguments, consider that we have two hostile fleets approaching each other, and that they are each individually intent on seeking in their coming encounter either absolute victory or defeat ; they have each been duly apprised of their proximity to each other by the rapid signalling and falling back of their respective scouts ; they are prepared in every way ; the men are at quarters ; the roaring of the escaping steam from the boilers tells us that steam is ready for full speed ; they are nearing each other at a moderate speed ; accurate station is preserved, the ships are well up to each other in close order ; but in what formation ? We dare not say ! it must be left to the master mind of some future Nelson to select that formation which shall oppose the rams of his leading ships, well supported, to the rams of the weakest or least supported part of the ranks of his enemy ; if three rams can be opposed to two rams the advantage is obvious. Half an hour has elapsed, the scouts have all fallen back, the torpedo-boats are assembled together or told off to close and support their respective

¹ We had written this before the formation of Sir Geoffrey Hornby's fleet, and his report seems to confirm our views.

ships; each fleet having with alacrity obeyed the signals of its chief has rapidly resolved itself into his chosen formation. The fleets having increased speed are swiftly closing each other, there is little time now left for those in command to feel either anxiety or suspense; if both fleets are equally courageous they must in a few moments meet, bow to bow; the charge will be furious; the higher the speed, the better for that side which obtains it; the ships must rush at, into, or failing this, pass each other.

This charge will have been fatal to some of the weakest bowed ships, or to those which have not undauntedly presented the point of their ram to the opposing ram of an enemy; by preconcerted arrangement a rapid wheel of the survivors or those which are not crippled takes place; the charge will be renewed; guns hitherto silent will be rapidly and incessantly discharged, the dire disorder and confusion will be awful, there will be a mad medley of ships and boats, a roaring of escaping steam; the loud discharges and smoke of the heavy guns mingling with the horrid and perpetual rattling of the quick-firing and machine-guns, interspersed with the dull explosion of the torpedo and its consequent upheaval of water; such a scene once witnessed would be for ever indelibly impressed upon the memory of a beholder. Amidst such disorder the opportunity for the swift ram and torpedo-vessel exists; here the weak may in a moment conquer or demolish the strong, a torpedo-boat handled with skill and courage may fatally injure the most goodly vessel; it is needless to follow such a battle to the end, but it will be evident, as the noise and confusion subside, to which side victory is inclining; there will be left the sad spectacle of many a magnificent vessel disabled, water-logged, or sinking.

It is possible that the remains of each fleet will re-form and withdraw, in which case the first to receive a reinforcement of armour-clads, even if these should be of an antiquated type, will be able to renew the action and ensure a victory.

The question as to whether gun-fire should be opened or withheld when the first furious charge is taking place, is a momentous one. We think that when one fleet is rushing to the attack of another, there should be absolute silence, the eyes of every Captain should be concentrated on his leaders, firing might be, perhaps, permitted from machine-guns in the tops, but most decidedly not from big guns until immediately before the ships have closed and are going to strike each other, or point blank on passing, but no shot should be fired that was not absolutely certain of finding its billet in an enemy's vessel: after passing there should be no firing; it will be better to wheel and re-form with quietness and precision. After a charge such as we have depicted, contrast the advantages that would accrue to the fleet that had first wheeled and re-formed itself into a compact formation, over another fleet which, by continuing a wild fire, had its vessels still in disorder. With which should success rest on a repetition of the charge? Our views, as now expressed, would, however, be much modified by the introduction of that really great desideratum, a smokeless powder.

We do not mean to lay it down as a positive rule that such sharp and decisive attacks as the one we have endeavoured to describe will always obtain; it is quite an equal probability that if one of two hostile fleets knows that it has the heels of the other, it may be at first successfully manœuvred so as to limit the battle to an artillery duel; but if close action be resolutely pushed and sought for by the slower fleet, the battle must assume the appearance of a retreat and a pursuit. Here firing will be constant and necessary, then we shall find the fastest ships of the pursuing fleet pushed on to the attack of the rear of the enemy; they will be accompanied by torpedo-boats, who will take shelter behind them, when any of the ships of the retreating fleet are brought to bay, and are in danger of being destroyed, a general action as before will be then imminent.

It is not altogether improbable that two fleets of about equal composition and strength may elect to simultaneously advance their torpedo flotillas, and these may have a separate action of their own, apart from the combat of the hostile armour-clads.

Of one thing we may be definitely assured, it is that we shall never have another repetition of such fights as those so well fought in the Bays of Aboukir and Trafalgar; the fleets of our future enemies will never now be found at anchor, or lying to at sea, to await our attack. A fleet that is desirous of avoiding the attack of another fleet must seek the refuge of some strongly fortified port, or a harbour with a narrow entrance that can be rapidly defended by submarine mines,—this change of tactics has been accomplished by steam, by the ram, and by the locomotive torpedo.

We may, however, justly surmise that the fleet battles of the future will be fought out on or near the old historical battle waters of Europe, the lack of coaling stations and distant dock accommodation will forbid the fleets of foreign Powers from assembling in distant parts of the globe for many years to come.

It is most difficult and almost rash on our part to hazard an estimate of the part that locomotive torpedoes will play in future fleet actions; we have said that their general employment must, at first, be most carefully restrained, but when we know how great their powers of destruction are, we must all feel how great will be the temptation to use them, and it would seem almost unwise to let any opportunity for their successful use slip by, not knowing when it may again occur. All experiments go to prove that it is useless to fire locomotive torpedoes at ships that are end-on, the target thus offered is small, and the least slow or swerve of the enemy avoids the torpedo; the wash of the screw astern, or a large bow wave ahead would also deflect these underwater missiles. But it has been clearly proved by experimental practice that when a fair shot at a passing vessel which is exposing her flank at any distance inside 300 yards is obtained, every torpedo should strike her bottom, provided at least that her speed were correctly estimated to a margin of a couple of knots.

On this basis we form an opinion that on the opening ramming encounter of two hostile fleets taking place, the use of locomotive

torpedoes will be withheld, or they will be only fired at the discretion of some very responsible Officer, possibly the Captain alone. Two ships passing each other at a speed of 10 knots would give a good chance to an expert operator with the Whitehead torpedo, more so if the two ships were abreast of each other and steaming in the same direction, or equally so if one ship shall expose her flank to the bow torpedo discharge of her adversary; a locomotive torpedo then expertly fired ought seldom to fail.

Much of course will depend on the speed of the torpedo, the old 10-knot Whitehead would be useless for such warfare, and a 30-knot weapon, if it can be got, will give double the chance of a hit that the present 20-knot Whitehead affords.

Locomotive torpedoes make it a hazardous manœuvre to pass under a ship's stern after failing to ram her; here a grand chance is offered to the stern torpedo of the rammer; aimed at the bow of the would-be rammer, as it passed under the stern, it could hardly fail to hit a mark which would extend 300 feet in length.

We do not think that such opportunities as this will often be offered in a single-ship action; for in her wise endeavours to avoid the ram of an opponent, no ship will willingly expose her flank to its attack, hence it is unlikely that one ship will pass under the stern of her enemy at right angles to her course; but the ever-varying contingencies of a fleet action are quite another thing, and such opportunities will then be sure to occur.

CHAPTER VIII.—*Attack and Defence of Ships; Fleet Manœuvres.*

It is the ram, and the ram only, that has revolutionized modern naval tactics, although their basis still remains the same, viz., to oppose at all times a superior force to some part of the enemy's formation; to do this, as far as the improvements in ordnance are concerned, we might well follow the simple tactics of our forefathers; and, again, as far as locomotive torpedoes are concerned, the tactics that were governed by the gun would be equally applicable to their advantageous employment. But the ram is a fixed weapon, it is attached to and can be used solely from one portion of the vessel, in its presence a long line of ships, such, for instance, as the well-known line of battle of our predecessors, becomes the weakest of all formations; we distinctly assert (unless the fleet were very large) that within sight of an enemy's fleet, there should never be more than four ships in a column, and that on such occasions the whole position and assignment of the ships that compose a fleet should be rendered as compact as possible.

It will be sufficient for us to cursorily glance at the annexed diagrams to at once detect the great weakness of an extended line in so far as the ram is concerned, and we say that in the commencement of fleet actions the gun and the locomotive torpedo must be subordinated to the ram; to successfully ram should be the first object; to destroy with the locomotive torpedo and gun the secondary purpose.

In our Diagrams, Figs. IV and V (Plate XI), Fleet A has twelve ships formed in single column line ahead; Fleet B has the same number of ships formed in three columns in line ahead; the ships in each column are two cables distant from each other; we suppose the columns of the Fleet B to be six cables apart.

We have depicted the look-out vessels of each fleet as having fallen back, and then formed themselves in columns; the torpedo flotillas have also been shown each closed up to the support of its own fleet; we here cease for the present further mention of these vessels for the sake of simplifying our argument. It is by no means certain, however, that it would not be very excellent strategy to precede an attack with the ram by a torpedo-boat attack, the confusion which such an attack would create should admirably serve the designs of the rams; or torpedo-vessels may equally with advantage be individually attached to the vessels of each fleet, taking shelter under their large consorts until they were close to the enemy; meantime following the movements of their sheltering ship as closely as the pilot-fish follows the shark. But for the present, as we have said before, we omit much mention of them, for in fleet manœuvres ships must in no way be impeded by their satellites; it will always be the principal duty of the latter until actively engaged with the enemy to avoid hampering the rapid movements of their fleet, who will as far as all manœuvres are concerned ignore their presence. If they get in the way, or get even run over, it must be their own fault.

Fleet A is in the simplest of all formations, each ship has only to follow in the wake of her leader and to preserve distance from her alone.

Fleet B is also in an almost equally simple formation, but the leaders of its columns have also to preserve their bearing and distance from each other, which has to be done by angle and bearing, there being no wake of a ship ahead for them to follow; in this formation, no ship should be more than fourteen cables from another; this fleet is in one of the best possible dispositions for signalling the leaders of columns; repetition of the Admiral's signals being clearly discernible to all the ships.

Fleet A has the advantage of having the whole of its broadside guns clear and free to open fire, and if Fleet B were content to answer gun-fire by gun-fire alone, we might rule that Fleet A had the strategic advantage to this extent.

But to those who know the powers of the ram, it will be evident that this would be the last thing the chief of Fleet B would wish to do, and also that he has every reason to be well satisfied with the compactness of his formation.

We say that, favourably placed as he is, he would at once alter the course of his fleet simultaneously eight points to port, the ships will then be in column in line abreast, heading for Fleet A. What tactics are now open to the leader of Fleet A? We see that if he steamed ahead with unaltered course his rear ships would be cut off by Fleet B; if he turns also to port it will become a retreat and a pursuit; the last and possibly the wisest plan is to turn and face Fleet B (see

Diagram, Fig. V), but even then in the charge that will rapidly follow, his line must be broken and cut in two; the leading division of Fleet B, supported as it is by its eight following ships, can at most be opposed by six of Fleet A's line; the centre and sternmost divisions of B in their turn being first opposed to ships already disordered and broken by the attack of their leading division should have a fair prospect of ramming them.

Presuming that the rear division of B is twelve cables astern of its leading division, and that both fleets are approaching each other at 10 knots speed, there will only be an interval of four minutes from the time that the leading division breaks the enemy's line until the rear division encounters what remains of it.

After the charge, Fleet B should have the best chance of quickly re-forming to renew it, only on this occasion its former rear division should head the attack. It is our deliberate opinion, as we have said more than once in this essay, that the first thing to do after breaking through the ranks of an enemy is to rapidly re-form and head for him again; this should be thoroughly understood and inculcated before going into action. The ships of a fleet when scattered or disordered must go down one by one if vigorously attacked by the rams of an enemy who was still formed in a compact phalanx.

But it is open to the Commander-in-Chief of Fleet A to adopt another plan to meet the threatened attack, though its adoption will involve the total sacrifice of his formation, and he must therefore positively abandon all further idea of solidarity; he can, on discerning B's plan of attack, signal his ships to use their best speed, and acting independently of him and of each other (and as shown by the dotted lines of Diagram, Fig. V), to close and do their best to ram the enemy; here his rear ships might, on wheeling, have a fair chance at the broadsides of Fleet B's port wing and rear ships; but the great confusion into which Fleet A will unavoidably fall, from all its vessels closing each other on different courses, must, even if the efforts of certain ships to ram their enemy be successful, yet be fatal to their further success, *i.e.*, when the remnant of Fleet B has wheeled and renewed its attack on the disordered remnant of Fleet A.

We think we have sufficiently demonstrated the inutility and unmanageableness of our old and once famous line of battle, at least when it has to confront and receive the attack of a more compact formation.

The group system has many advocates, and its use undoubtedly confers many advantages; its principal drawback, however, being the difficulty of accurately preserving a formation which is naturally somewhat intricate and which cannot be accurately preserved by eye and judgment alone; a few rapid alterations of course, the ships turning together, leaves any form of groups in apparent disorder, even though the original bearings and distance have been most accurately preserved. We do not believe in the face of our enemy's fleet or squadron that any formation which requires frequent sextant observation and more frequent compass bearings, calculations, &c., can be well preserved; we hold that the Captain's eye alone should be the instru-

ment to keep his ship in station under such circumstances. This can be done with precision when a fleet is formed in columns in line ahead or line abreast; here those who have had any considerable experience in fleet tactics can, by their eye alone, with a touch of the helm, or by the decrease or increase of a revolution or two of the propeller, keep their ship in perfect station. A statement that the more simple the formation, the easier it is preserved by the fleet, will not brook contradiction. Diagram, Fig. VI, contrasts the strategic positions of two fleets, the one formed in scalene groups of threes in line ahead, and the other in columns of divisions line ahead; Diagram, Fig. VII, represents scalene groups in line abreast, and columns of divisions in line abreast, and is the necessary result of both fleets, as shown in Diagram, Fig. VI, turning towards each other. Here Fleet A appears to be certainly better placed to meet a ramming attack than if formed as in Diagram, Fig. IV; here its ships will be better able to support one another; but on the turn for a second charge as before we still think that Fleet B will have the best of the encounter. It has already opposed the rams of twelve ships to the rams of nine, for we hold the right of Fleet A to be out of the first charge; from opposing three rams to two, Fleet B should have at least disabled two or three ships of Fleet A, and if on the return charge Fleet A has not got into a more compact formation, Fleet B may again have the same opportunity. It will be always futile to pit the ram of one ship against the rams of two; the advantage Nelson gained at Trafalgar by making each of his leading ships engage two of the enemy, will not hold good with the ram. In the matter of Whitehead torpedoes it might still do so, but we much doubt the advantage of using these weapons from big ships, especially during the first onslaught of a fleet action, indiscriminate damage to friend as well as foe might result from so doing.

We shall now add a few more diagrams to represent other formations in which hostile fleets may oppose each other, but as we have said in another place it is at present utterly impossible to predict in what formation or by what strategy some future Nelson may overcome his foes, still we may be assured that it was only by means of long practice and constant study of fleet work, in addition to his innate genius as a Naval Commander, that our great hero gained his ever-glorious victories, in which, from the first sighting of the enemy's fleet, success was never doubtful.

Diagram, Fig. VIII, shows two fleets formed respectively in two columns of scalene groups of threes, and in three columns in line abreast.

Diagram, Fig. IX, exhibits the best formation for a retreat, viz., two bow lines; a retreat and pursuit must at first be only an artillery duel, and may perhaps continue to be so, that is if the ships of the pursuing fleet are of only equal or may be collectively inferior speed to the ships of the retreating fleet, but as any of those in retreat lag or drop behind and are attacked by the advanced vessels of the pursuers, then they must be either supported or abandoned; in the former case a general action with the ram would eventually ensue, greatly we think to the disadvantage of the fleet that was in retreat.

Diagram, Fig. X, represents a fleet (A) formed on their chiefs in two

quarter-lines charging another fleet (B) formed in columns of divisions in line abreast, the latter being the same phalanx formation which we personally so much esteem, and in whose very compact ranks all the ships so well support each other; which offers the same strength on either front, flank, or rear, and from which course can be altered together either to the opposite direction or at right angles, still leaving the disposition or rather the formation of the fleet unchanged; while a four point alteration of course only puts the ships in the columns into a four point line of bearing, which would also be a fairly simple and useful formation in which to make a ramming attack. It is not the same with Fleet A.

But were it not for these advantages which are inherent to the formation of Fleet B, we would fully admit and even advocate the power of the wedge-shaped formation in which Fleet A is formed; most powerful indeed is it as long as its apex is presented to the enemy, but it would be weak indeed if it were taken on either flank through being outmanœuvred by the enemy.

When a fleet (A) can be brought to the attack of another fleet (B) formed as we present them in our diagram under discussion, we say that to develop the full powers of the wedge the ships of Fleet A should, as their chiefs close Fleet B, rapidly edge in towards them, thus giving them great support, and giving a great chance of successfully breaking up the phalanx of Fleet B. It is evident here that Fleet B would find it more difficult to secure its victory than against any of the other formations which we depicted.

The advantages or disadvantages of the whole of the before-mentioned formations apply as well to the attack of torpedo-vessels as to the attacks of armour-clads, we presume that the former will also when in any numbers charge each other and try the issue with the ram.

We hold that when it is necessary to make a large alteration of course in sight of an enemy, the ships of a fleet should always alter course together and not in succession; ground should be taken to the right or left, ahead or astern, so that a return to the original course also ensured a return to the original formation, this formation to be favourable to an attack with the ram; once placed in a favourable position for such an attack there should be no doubt as to the next course, it should be ram on to the enemy. On first sighting an enemy any alterations of course which are requisite may be made by signal, but the order to charge being once given, it will then be alone the practised eyes and steady nerves of the different Captains that can give due support to the movement of their chief; previous to this we think it is important that all large changes of course or formation should be as much as possible avoided, a reserve of speed should be husbanded in all ships ready for the charge.

In connection with fleet manœuvres, it seems most advisable that the military masts of our new ships should bear long if slight top-masts, from one of them the Admiral's flag should flaunt high above the smoke and turmoil of the battle, it should be the one guiding star and rallying point of his Captains.

We entirely demur to the idea which has been discussed of the Commander-in-Chief of a fleet taking his post in some fast despatch vessel, from whence, outside the turmoil of the battle, he could signal and direct his fleet. In the first place we say that he could not do so, at the moment of the charge he would be helpless, in the second place he dare not do so: how could he in case of defeat meet the aspersions that would assail him? No! we hold alone with the traditions handed down to us from our glorious progenitors, well imitated as they have been by the gallant American Admiral Farragut at the battle of Mobile Bay, that it is still the duty of the chief to be in the very forefront of the battle; where the flag is seen flying there will the ships always rally.

Our future leaders must never forget the generous emulation of Nelson and Collingwood at Trafalgar.

We have already hinted at the advantages to be gained by selecting the ships that compose the respective divisions and subdivisions of a fleet, having special regard to obtain a similarity of speed and equality of manœuvring powers; where these quantities vary so greatly as they do at present, it would never do to assort the fleet in these days according to the seniority of its Captains; where ships vary in speed from 10 to perhaps 16 knots, the strategic value of an equality of speed in each subdivision is obvious. For instance, the Admiral could detach the fast 16-knot ships, who we will say formed the second subdivision of his fleet, against a retreating enemy, supporting them in their advance by closing up the next fastest subdivision, and so on, without destroying the order of sailing or disorganizing the formation of his fleet. Again, to facilitate a fleet manœuvre, it may often happen that the fast subdivisions can be made to perform that part of an evolution which requires the most speed, leaving the slower subdivisions to make good their best speed in the direction that the fleet was proceeding.

Or we may have one subdivision of each division composed of swift torpedo-vessels of the "Scout" or "Polyphemus" type, the other being composed of armoured vessels; the strategical advantages of such an organization would be great.

CHAPTER IX.—*Attack and Defence of Ships; Manœuvres of Squadrons and Single Ships.*

The attacks of squadrons and even of single ships will much resemble and be generally subject to the same conditions as the attack of fleets which we have before described; but more generally in the actions of single ships we opine that the gun will be the arbiter of victory in place of the ram and the torpedo. The same advantages, or perhaps greater, will be assured to the ship with the highest speed; it is the most rapid squadron or ship that can at will ignore the enemy, or deliberately choose its own time or method of attack, it can at its pleasure limit the action to an artillery duel, or force the use of the ram and the locomotive torpedo.

It will be found on trial no easy matter for a single vessel to ram a

well-handled and active adversary, unless the ramming vessel has not only a higher speed, but also a better turning power than her enemy; speed alone, though it will place her at will alongside her foe, will not of itself enable her to ram him. While seeking to ram another vessel, the would-be rammer will have to repeatedly expose himself to the attack of his antagonist's locomotive torpedoes; but he will, of course, also in like measure have frequent opportunities of using his own similar weapons.

We shall endeavour to illustrate the hopelessness of such a ramming attack by a diagram, which represents two vessels, x and y (Diagram, Fig. XI); x has the least speed but the best turning powers; if x refuses to accept an "end-on" ramming encounter, it will be seen that the superior speed of y will not suffice to ram x .

The apparent distances travelled in our diagrams are necessarily foreshortened and are not drawn to scale; it is almost needless to say that if y exceeds x in speed, say to the extent of two knots an hour, if it is a stern chase she will take three hours at least to get within fighting distance of x , that is if the weather be clear and the vessels should descry each other on a distant horizon; but if x awaits the approach of y or steams to close her, one half hour or thereabouts will place both ships within gunshot of each other. It is more than probable that they will both commence the action with gun-fire, but y is impetuous, and feeling confident in his speed, wishes to ram his adversary, who declines to accept this method of encounter, preferring, perhaps with good reason, to limit the fight to guns, or guns and torpedoes. Upon x deciding not to accept the ramming attack of y , he must turn away and thereupon y will pursue him (see Diagram, Fig. XI); here y has commenced his pursuit of x ; from this position both ships will eventually attain the relative positions shown in Fig. XII, and we presume that they will both be still maintaining a heavy fire on each other. Barring accidents y will soon have closed x near enough to allow him as in Fig. XII to put his helm hard a-starboard and so endeavour to hit x with his ram; but x , putting his helm also hard over at the same time, avoids the blow, and in a few seconds he will have ascertained that y by reason of his inferior turning power can never touch him; as long as he (x) elects to continue on his smaller circle y can only steam round him on a larger circle; y may outpace x and perhaps cross his bows, but it would be a dangerous experiment.

After this attempt, it is probable that y will take up a position on the bow of x and endeavour to decide the battle by artillery, or perhaps, being strong in the use of the Whitehead torpedo, he may place himself so as to most advantageously use that weapon. Ramming can now never be successful unless one or the other of the opponents be disabled by gun-fire or torpedo, or else commits some serious error of judgment; such catastrophes may occur as well to the one as to the other, there is no reason why they should favour the ram of y more than they do the ram of x .

Our diagram very forcibly illustrates the necessity of a ship placed as x is in Fig. XIII being competent to put her helm hard over rapidly by steam power, the slowness of manual labour would never allow her

to avoid the impending attack of y 's ram. In all ramming encounters it is most imperative to safety that ships should possess the power to put their helms hard over when going at their highest speed. We are by no means sure that our own ships are well found in this matter.

If, however, in contradistinction to what we have just illustrated, x should decide to meet the threatened ramming attack of y by a counter ramming attack, the ships will meet as we have described in a previous chapter, or rush swiftly past each other, pouring in a rapid fire; here machine-guns and repeating rifles will play a decisive part in the battle. This was well exemplified in the encounter of the "Bouvet" and the "Meteor;" these vessels at first tried to ram each other end on, but missing, rushed past each other, the rapid fire poured in by the "Bouvet" on passing was most destructive to the crew of her adversary.

A good repeating rifle ought to be the naval small arm of the future not only in ships but in boats, especially in torpedo-boats; a rapid-firing small arm will be essential to success on many occasions. The French have introduced a repeating rifle into their Navy, and their Officers speak highly of its merits, although our own authorities allege that it has some imperfections.

It is needless for us to attempt to follow up this attack; after the vessels have rushed past each other nearly everything will depend upon the nerves and courage of their respective Captains, as well as upon the amount of training and good seamanship that they have acquired. We have not the space at our disposal to enter deeply into the various stratagems and manœuvres that might be practised by that Captain who was a well-trained adept at ramming; also we need not follow out the question as to whether either vessel should, after passing, turn to the same or in the opposite direction to her adversary; it will be sufficient for us to admit that an entire essay might be written on the subject of manœuvring ships so as to ram or to avoid the ram, and the question is terribly complicated by the developments of the locomotive torpedo. What we could say if we had the space to do so, would in great measure be a repetition of the writings of Captains Colomb, Noel, and others, or of Admirals Randolph and Fremantle, or of the French Admiral Bourgois, all of whom have ably handled their subject.

But we do think that it especially appertains to our essay to show the greater advantage that two ships have in attacking one, owing to the ram, than they have heretofore had; an advantage that is most certainly relatively far greater now than when sea battles were decided by gun-fire alone; then it was two to one, now it is still two to one; but in the old days the single ship could ply both broadsides against the two engaged broadsides of her adversaries; now it will virtually be, as far as the ram is concerned, one ram *versus* two rams. In Diagram, Fig. XIV, for instance, let us suppose x to be a single ship attacked by two vessels faster than herself, y and z , all three vessels being of about the same turning power, armament, &c., or we may even allow z to be inferior in size to x and of less powerful gun armament; but

while weak on these points she is yet equally well fitted to ram or discharge Whitehead torpedoes.

Before commencing the action y signals to his consort, "I will endeavour to force a ramming attack or make x avoid me; you keep well outside the circles we shall describe and seize your opportunity to rush in and ram him when it occurs." Thus hunted, x should theoretically in due course be rammed, if not by y at least by z , as will be seen by our diagram.

We may imagine that y will keep up a continuous fire while he is hunting x , not only for his own preservation but to confuse his opponent and take his attention off the movements of z , who should with calm precision await her chance; it is necessary that y should stick close to the port quarter of x so as to prevent him from turning to port; in this position his ram will threaten the rudder and screw of x who will have to be most careful.

These are the vulnerable points of all vessels, the least touch of the ram will be sufficient to jam the rudder or smash the steering gear; equally liable will be the screws to injury or derangement.

But instead of planning the destruction of x in the way we have so roughly delineated, it is open to y and z to place themselves on either quarter of x as in our next diagram (Fig. XV), when each ship will do her best to hunt x across the bows of her consort, much as two greyhounds hunt a hare as indicated in position 3, when z is able to ram x .

It is hardly within the scope of our essay to discuss the attack of gunboats on large ships, except to mention that the larger vessel who has accepted combat with gun vessels or gunboats—which by reason of her speed she should usually have the option of declining—she might endeavour to hunt them down one by one and so sink them, but we should not advocate the gunboats awaiting such an action, for we hold that by reason of the recent great improvements in quick-firing and machine-gun fire, in addition to the improved methods of mounting and greatly increased arc of training, &c., that can now be given to large guns, the attack of gunboats on large ships is at the best a very hazardous proceeding; the large vessel should in the open waters be able to close and overwhelm them one by one by sheer force of her superior gun-fire.

For the attack and defence of harbours, gunboats will find more suitable work than by venturesomely attacking large ships, and we shall have more to say of this in a later chapter. We must remember that, even in the old days, gunboats seldom ventured to attack even a frigate unless she happened to be becalmed and helpless.

For the purposes of attack and defence we still favour what gunboats cannot well carry, *i.e.*, the retention of armour, even of a moderate amount, in all ships, to be placed more especially on the vital parts, such as the machinery, boilers, steering gear, and conning tower; at least two guns should also be protected with armour in all ships large enough to carry it; in smaller vessels protection should be given by steel shields to the guns' crews, so as to save them from the hailstorm of machine-gun fire which would otherwise rapidly sweep down the men.

In the attack and defence of ships it will be hopeless to expect the unarmoured ship to be, except under some very exceptional circumstances such as being an exceedingly swift torpedo-vessel, successful against an armoured ship. In the matter of small and swift torpedo-vessels, the unarmoured may, it is true, by seizing their opportunity, destroy the armoured vessel, but where there is any general similarity of size, speed, and armament, the armoured vessel should have the advantage.

We may, however, in future naval wars see an entirely new phase in ship actions entirely different from those we have attempted to depict; we may, for instance, have an engagement between two vessels constructed to fight on entirely different principles, such as a fight between a corvette and a large torpedo-cruizer, such, for instance, as our new "Scout" class, whose strong point is alone her torpedo armament, while the corvette would rely mainly on her gun-power. On the meeting of two hostile vessels, the one being a "Scout" and the other we will say like our "Canada," it will be evident without much reflection that the only chance for the former is to rapidly close with her adversary, and that her chances of success or failure hinge entirely on her getting within 300 yards or effective Whitehead torpedo range before she has been knocked to pieces by the superior gun-fire of her opponent; at this short range, few shot or shell should miss her, but she should all the same, if once there, surely get a torpedo home to the bottom of her enemy. We do not insinuate that our "Scouts" are designed for this sort of engagement, especially in the day time, but at night or during thick weather their chances of success are good; it is established beyond the need of argument that such vessels are a necessity of modern naval warfare, they would be especially valuable as the consort of a big armour-clad vessel, which they would save from much work that would involve a heavy coal expenditure, they would be invaluable to beat off a torpedo-boat attack on such a vessel, and their exceedingly formidable torpedo armament will even allow them to take an effective place in the battle array of a fleet.

CHAPTER X.—*Attack and Defence of Ships; Torpedo Attack and Defence.*

Both in the battles of fleets or squadrons, and also in the action of single ships, the greatest possible advantages may be derived by the one or the other of the antagonistic vessels, who can make the most intelligent use of a strong supplementary force of torpedo-boats or torpedo-vessels. The active co-operation of such craft will be in many cases absolutely essential to success.

We are confident that in the future these swift boats will be made more seagoing than they are at present; even now a larger and far superior class of boats are being constructed both at home and abroad; these new boats will on most occasions be able to accompany a fleet on a short cruise or from port to port, being attached either singly or in pairs to individual ships. It will be the duty of the parent

vessels to keep their tenders well equipped, coaled, and supplied with water and provisions; under their protecting side they will take shelter, until they are close enough to an enemy to rush rapidly out and discharge their torpedoes. A sudden attack of this kind would be sure to confuse any ship who was manœuvring to ram or avoid the ram of a hostile vessel, it might even tend to throw her across the ram of her opponent, or *vice versâ* the threatening ram may materially assist the onslaught of the torpedo craft, to say nothing of the great advantages to be gained by such a diversion in the way of drawing off or dividing the full force of the machine-gun fire, which would otherwise be relentlessly poured into the opposing ship alone.

If a large proportion of torpedo craft form a part of the strength of two hostile fleets who are about to engage each other, it is probable that both the torpedo flotillas may be advanced, or be otherwise detached to fight a separate action on their own account, outside and immediately preceding the impending fleet battle. The possession of a preponderating force of torpedo-boats, cruizers, and hunters will be so beneficial to the fighting strength of a fleet, that it is hard to say what will be the eventual limit of their numbers. We may be sure that the first efforts of any Great Power who has embarked on a maritime war will be to rapidly augment her torpedo forces; all sorts and descriptions of fast vessels will be either purchased or hired and then fitted as make-shift torpedo craft; their armament of Whitehead torpedoes being supplemented with machine and quick-firing guns; at the same time every effort will be made to produce *bonâ fide* torpedo-vessels with the greatest possible facility.

We have in the American civil war a very notable example of what can be done in the way of extemporizing a naval force; both the Federals and the Confederates made use of any vessels they could lay their hands upon. And again, in the Chilian and Peruvian war, the Chilians made good use of the "Angamos," a merchant steamer armed with one long-ranging gun. It is of course undeniable that merchant or passenger vessels, which are thus extemporized as war-vessels, can never be the equal of those vessels which have been carefully designed and constructed to fulfil the purposes of war; but all the same, any vessel with high speed that can be armed and utilized with machine-guns and torpedoes, becomes an unit of naval power, and a combination of these units must be classed as an important factor in the naval strength of any country.

It is thus that we hope to see torpedo warfare utilized and adapted as an integral element of England's naval power; we have always mistrusted the power of the very limited number of battle-ships in which we have of late years at great hazard to ourselves reposed our confidence. The cost of such vessels is so enormous that we are convinced that it is vain to indulge in the hope of their numbers being ever sufficiently increased, our respective Governments, no matter whether Conservative or Radical, bidding as they always do to catch the votes of the taxpayers at the next election, dare not vote the high sums necessary to give us an adequate fleet of armour-clads; we mean a sum sufficient to put our fleet on such a permanent war-

footing as to render it equal to any possible combination of foreign Powers or other hostile emergency. The endurance or staying power of our armour-clads is so bad in connection with the wear and tear of boilers and machinery, that we cannot be justified in ever considering more than two-thirds of the total number as efficient.

Then, if this be so, we surely ought to recognize with thankfulness any means by which we could on the outbreak of war rapidly augment our naval strength.

Most fortunately, then, if rapidly extemporized craft can be a source of naval strength, we have in England this ball at our feet; there are in daily use numerous small and fast vessels, which might be put on our Admiralty register for hire or purchase in the event of war; and again, our maritime resources permit of our constructing such vessels in great numbers with unequalled rapidity.

If the gun were the sole arbiter of naval warfare, such craft would be useless and unavailable for war purposes, for many have neither the requisite tonnage and none have sufficient strength to carry guns heavy enough to batter in the side of an armour-clad or protected vessel, but they may now be easily made the equal of armour-clads as far as torpedo power is concerned.

We are often disposed to think that the time is not far distant when ancient history will be repeated, and that in the naval wars of the future we may, instead of finding the opposing fleets of two nations when sent out to fight limited to some twenty large ships on each side, find them consist, as they did in the days of the Greek, Roman, and Carthaginian sea-fights, of some three or four hundred vessels. Anyhow it is evident that the ram and the locomotive torpedo have a strong tendency to drive us in this direction.

If this does happen, and we think it will, it must be to the manifest advantage of old England, with her unrivalled naval resources; we do not think that the ironclads of to-day or of the last quarter of a century at all coincide with the ancient traditions of our Navy and its seamen.

It was not by reason of the strength and hugeness of their ships that our seamen of old overcame the Spanish Armada. Here, so far as the size of their vessels were concerned, they were quite over-matched; but the well-handled swiftness and agility of the English vessels, added to the good seamanship and bravery of their Officers and crews, under God's directing Providence, drove the monster Spanish hulks out of the English Channel, only to find disaster and shipwreck during their retreat on other parts of our coasts.

We ought never to forget that the glorious development of our war Navy with which we are so familiar is only a slow growth resulting from the daring, persevering, and ambitious merchant-trading of our seafaring forefathers.

It is a fact, however, that the press-gang and seventy years of naval peace had in combination with other circumstances in great measure separated the two great services of England, her war and mercantile navies, but we rejoice to see that of late years there has been a tendency to consolidate them; it should be the daydream of our

statesmen to make both the ships and the men of our vast mercantile marine a subsidiary force in time of war.

We have said much in favour of small torpedo-boats, particularly for night attacks on anchored vessels, but we do not under-estimate the power of machine-guns carried by such vessels as we have just advocated, and we would now endeavour to make it clearly understood that we think that since the construction of torpedo-hunters and torpedo-cruizers, and the great improvement in machine-guns, the smaller class of torpedo-boats do not now stand relatively in as good a position for ship attacks as they used to do a year or two ago.

We say, without hesitation, that the attack in daylight of say half-a-dozen torpedo-boats against even a slow armour-clad ought undoubtedly to be beaten off, though if they converged on her from the different points of the compass, she might be in a position of considerable danger; we say even a slow armour-clad purposely, for against a fast armoured vessel, such, for instance, as our "Colossus" or "Collingwood," they would have but a poor chance of success.

To ensure victory, torpedo-boats ought to have a large excess of speed over any vessels they may attack in the day-time; then with them, rapidity alone means success, the want of it, destruction.

But, as we have said before, the day attack on a costly ship is not necessarily limited to three, four, or even half-a-dozen attacking boats; by using, say thirty boats for an attack on a modern armour-clad we should not have reached her total cost, by using fifty we still have not much exceeded it, the loss of half these boats could be replaced in a few months, but sink an armour-clad by one or two of their torpedoes, and it would take at least three years to replace her.

The attack by day of fifty torpedo-boats against two or three armoured vessels would be a very serious affair for the latter; we can only compare such an attack to one of those of which we read of men on foot being attacked by a herd of the peccaries of South America, many would fall to the rifles of the men, but without shelter for the men numbers must prevail; the resolute attack of fifty torpedo-boats ought in smooth water and under favourable conditions certainly to prevail against unsupplemented armoured ships. The ability of torpedo-boats to attack large vessels must naturally much depend on the state of the weather, while torpedo attacks benefit by thick weather, it would yet be the direst folly to suppose that our present first class boats, even if their Whiteheads could be relied on, could successfully attack armour-clads in a heavy seaway; their reduced speed would place them at the mercy of the larger vessels. Large torpedo-cruizers of the "Scout" class would not do a great deal better; it is but just, however, to say that we can find very few records of naval fights in heavy weather; we may presume that they will still be the exception and not the rule.

The problem being given as to what would be the quickest and surest way of providing a power capable of destroying a given force of armoured vessels, whose destruction was necessary at any cost, it

can only be answered by urging the construction of numerous swift and powerful torpedo-vessels; it would be too slow a process to construct an equivalent force of armour-clads. The latter could only be most hurriedly built in from two to three years; given the necessity, we in England, with our present resources, could create and equip a very numerous flotilla of torpedo-boats in from six to nine months.

During the next maritime war the waste in torpedo-boats will be enormous; their construction is naturally most fragile, and hard night work and constant steaming, especially when in company with a squadron, would be most trying both to the boats and to their crews, to say nothing of the frequent casualties which must happen to them when engaged with the enemy.

The day attack on ships by torpedo-boats will, as we have already said, always require a large force of the latter, co-operation must be their motto; their attack must be simultaneous as well as swift.

If the ship to be attacked is given time, that most essential of all elements in beating off a torpedo-boat attack, she may be able to destroy most of the boats in detail.

A flotilla of fast torpedo-boats when meeting an enemy's vessel at sea, and the day and weather being favourable to their attack, should spread themselves around her at a distance of at least two miles as in our Diagram, Fig. XVI, where we represent ten boats spread with the view of an attack on a ship; from these positions by preconcerted signal, to be given by the sternmost boats, which would keep within sight of each other, they should make a rush for their opponent, and if in smooth water they should in six minutes from the signal be close enough to discharge their torpedoes, and then retreat if necessary. Six or even ten minutes seems but a short time to destroy ten rapidly approaching boats, and we doubt the possibility of its being done.

A gun or rocket should be the signal to close.

In the above diagram it is evident that if one of the ten boats is able in the course of these few minutes to get a Whitehead torpedo home, it is all that will be wanted, success being ensured even if half the torpedo-boats have had to succumb or sink under the vigorous and well-directed fire of their victim, who has to contend against her own smoke and the confusion that such an attack on her would be likely to create.

To our mind all experiments that have yet been made in destroying torpedo-boats by machine-gun fire have grossly favoured the guns at the expense of the boats; we insist that it is a totally different affair, coolly firing when steaming at 10 knots towards one drifting or anchored boat, to firing from the platform of a ship with some motion, and with the men who are firing all under the influence of the strongest excitement at perhaps ten boats approaching from different directions at a 20-knot speed.

If the machinery of a torpedo-boat is not struck and disabled, it will take very hard hitting to stop her, at high speed very little water enters the boat from small shot holes.

In a rapid attack of this nature no time would be given to the

armoured vessel that was attacked to stop and rig out her nets; and as to the feasibility of a vessel cruising with her nets rigged out, the idea is to our mind preposterous.

We regard crinoline protection to armoured ships as a fallacy, though we do not despair of seeing ere long a class of vessels built that may be fairly proof against the attack of locomotive torpedoes, but it will not be from crinoline protection that they will obtain their immunity, but from the stoutness of their bottom, their numerous cells and internal subdivisions, and the skilful way their engines are secured from the effects of an outside under-water explosion.

We would not, however, despise a crinoline protection if it were fitted to a vessel which was solely to be employed in removing submarine mines placed outside a harbour, or in some channel or passage that must be cleared; under such circumstances there is room to lose speed to secure protection, and we think the next war will see some such class of bottom-protected vessel developed and employed for such work; but for seagoing work, anything that would so retard the speed of a ship could not be tolerated for a moment; let us picture to ourselves the anger and vexation of one of our Captains who was unable to overtake a foe through being encumbered with a crinoline protection.

Whenever a ship was attacked by torpedo-boats in the way we have described in Diagram Fig. XVI, it would seem to be the best defence for her to rush at two or three of them, and endeavour to single them out for speedy destruction, trusting to be able to avoid the discharge of their Whiteheads, rather than await a joint attack.

If the day attack of torpedo-boats be as formidable as we have represented it to be, then a night attack must, of course, be infinitely more dangerous.

To give our idea of a night attack on a fleet of torpedo-boats, we shall have to quote from a paper read at the Royal United Service Institution and published in its Journal, vol. xxviii, page 30; it so entirely represents our views on such a matter that if we attempted to explain them without quoting or referring to it, we might be justly accused of plagiarism.

This paper says: "We will suppose an enterprising and determined enemy, commanding a force of some twenty Thornycroft torpedo-boats. He has ascertained (how we need not enquire) the actual force and position of a hostile armoured squadron on some particular night, the weather on the occasion being favourable to a torpedo attack. He issues orders to his torpedo-boat force somewhat as follows:—From information that I have received, I expect to find an armour-clad squadron of the enemy 50 miles north of Ushant. I contemplate seeking and attacking them about midnight. It is my direction that you are in readiness to proceed in company with me at 8 P.M. You will then weigh together and take each other in tow in order of seniority. It is my intention to steer to the north at 10-knot speed. The greatest caution is to be preserved in regard to silence, all lights are to be thoroughly concealed and covered. It is my desire that any look-out vessels or guard-boats of the enemy should

be most carefully avoided. But should they discover us and action be unavoidable, the four sternmost boats are to cast off and endeavour at all costs, and regardless of hazard, to sink or destroy them, parting company then and there from me, and returning to port at their own discretion.

"On discovering the enemy you will by my order cast off and, forming line abreast, dash for him at your highest speed, acting independently of me and of each other, using your utmost exertions to successfully fire your torpedoes, which, having expended, you will, after the attack, having to the best of your ability supported each other, return to port also independently of me.

"I pause here to ask if a squadron of armour-clads when at sea and unaided are efficient to successfully combat an attack of this nature. Those who know the condition of a squadron on a dark night at sea, and who have seen the uncertainty that ensues when two or three ships are thrown out of station, or the watchfulness and caution required during the performance of any manœuvre involving a large alteration of course, can best imagine the effect of twenty swift vessels approaching, covering the mile that they will be seen easily under four minutes, &c. . . ."

If this description of a night attack on a fleet is not overdrawn, and we do not think it is, what precautions must fleets take to prevent their own destruction by such an attack?

In the first place their whereabouts on any particular night must be alone known to the Admiral commanding, each evening at sunset the larger vessels must by his orders stand off together on a different course and at a different speed from the previous night, more especially so on very dark nights or in foggy weather. When it was clear enough weather and on moonlight nights fast scouts should be spread inshore of the fleet, prepared to use a well-thought-out private alarm signal, simple and thoroughly understood by all.

Now comes the all-important and as yet unanswerable question, How is a night torpedo attack to be received by a fleet? Is every ship to carry her torpedo-nets out? We say No! At sea this is certainly impracticable. Are all ships to use the electric light and search the horizon? Here again we say No! The electric light unless used with the greatest judgment may blind your friends, and is as likely to lead the attacking boats to their quarry as to discover them in time.

Then, again, are the ships to have the option of opening fire on any boats they may see approaching? There will be little time in dealing with a torpedo-boat attack to think, let alone to signal and ask permission to open fire. Once again we say No! Firing, and especially an indiscriminate firing, would lead to confusion and favour the attack; it would prevent the use of scouts, for with scouts out fire could not be opened on a rapidly approaching boat, for it might destroy friends instead of foes. If firing is to be allowed to beat off an attack, scouts must be forbidden to close until daylight. Here we have exhausted our vocabulary of the modern antidote to torpedo attack, and we have approved none of them. Our reasons are good: all the plans detailed

are more or less imperfect; there is no absolute safety in either of them. Well, what can we suggest? As far as they go, nothing. To my mind the one way to successfully meet torpedo attacks will be by counter-attacks, not made by monster armour-clads, which latter should be carefully moved away from the possibility of such attacks, each night to a fresh position, which will be signalled to the fleet before sunset on each day, and who when moved might then lie, if in absolutely smooth water, with their torpedo nets spread around them, showing not the vestige of a light, trusting to the vigilance of their smaller allies for their safety during the night. But if it was absolutely necessary for the due execution of the duty required of them that a fleet should lie in the vicinity of a port known to contain torpedo-boats, then one or all of the precautions we have referred to might at the discretion of the Admiral be adopted.

One of the first things to strive for would be that the egress of the port should be illuminated by the electric light, so that any vessels coming out should be detected. Two vessels might when possible be stationed to throw the rays of their lights on the entrance; in their shadow numerous torpedo-cruisers, hunters, &c., should lie in wait ready to pounce on all who came out into the beams of the lights. Where the depth of water admitted a series of mines might be laid outside the port to hinder the exit of large vessels. But increasing and unwearied vigilance must be the great safeguard, and constant feints and attempts to cut out or blow up vessels in the port must be the invariable reply to a torpedo-boat sortie. The blockading force should daily and nightly strive to keep the defenders so harassed that they should be unable to organize counter-attacks. As we have more than once said, armoured ships of any size are too costly and otherwise quite unfitted for this work; small and active vessels must do it, who should use the armoured vessels as their base of operations. It would be most desirable in a strategic point of view if the armour-clads could seize and fortify any harbour in the vicinity of their operations wherein they could occasionally rest, coal, and make good small defects, &c., while in very bad weather when the blockade could not be either maintained or easily broken the ships might find a safe haven.

The great danger of torpedo-boat attacks is of course the extreme uncertainty of the time and place when they will be made; these small and swift boats might be taken in fine weather at least 60 miles from their port for a night attack and be home again at daylight. It will be almost an impossibility for a fleet to watch ports 60 miles on either side of them; undoubtedly, steam and torpedoes greatly militate against an effective blockade, and they are both in this way a disadvantage to a naval Power like ourselves, who could in the old days fairly well blockade the coasts of our enemies.

But great speed is not alone of use to the blockaded or those who wish to run the blockade. In our next chapter we shall hope to show the material advantage it can give to the blockaders.

When vessels have been brought to an anchor within the range of a possible torpedo attack there are many ways to defend them against

the night attack of boats armed with Whitehead torpedoes, and more easily against the attack of spar torpedo-boats; but we know no way of defending them from the attack of rams or large torpedo-vessels except by an elaborate system of electro-contact submarine mines; all other obstructions could be so easily forced by powerful steam vessels that they are hardly worth thinking about; we say, therefore, that where there is a possibility of a combined ramming and torpedo attack, a fleet should not be anchored unless the entrance to their anchorage was narrow and was elaborately defended by mines.

One method of defending vessels at anchor against night torpedo attacks would be to have an arrangement of floating grass lines, one behind the other in series, about 700 yards from the ships, each line to have distributed at intervals along its length small buoys or floats, each float to carry a Holme's light so fixed as to be quickly submerged if a torpedo-boat fouled the line. These lights are at once ignited on contact with water, and continue burning, being most difficult to extinguish. If, then, a system of grass lines were laid on this plan across a harbour's mouth, and guns were placed so as to both rake and enfilade them, the moment a torpedo-boat fouled a line and immersed one or two buoys in her vicinity, then the electric light should be turned on and a heavy fire opened. The firing should cease after a very short interval, when guard-boats should at once sally in pursuit of the enemy's boats. Any plans of this kind should be most carefully pre-arranged; in a defence against torpedo-boats nothing must be left to chance. You have already to contend against the probability of the confusion likely to arise from the sudden attack of unseen foes without adding to the danger by allowing indiscriminate firing, which might result in ships firing on their own guard-boats or even into each other.

Another plan would be to trust more to the electric light; this should be arranged so as to cover the whole zone of approach to the ships, which should be moored with their guns carefully laid for it to be fired by electricity by the Officer on the look-out immediately a boat entered the illuminated zone. It has been proved that the rays of the electric light greatly confuse approaching boats, and render it very difficult for them to estimate their distance from it. The side of the ships exposed to attack should have nets outriggered from it, and a further system of floated torpedo-netting, moored about 50 yards distant from this. We hardly think a torpedo-boat could have much chance of success against this system, but it could only be applied to a narrow harbour with one approach. A large vessel could of course force this with ease, but she would have first to run the gauntlet of the cruisers left in the offing and the guard-boats armed with the Whitehead torpedo which would be stationed along the shores.

A boom, such as was used in the late experiments at Berehaven, will of course stop a torpedo-boat, but it takes too long to fit to be called an extemporary defence, and in war-time we doubt if the necessary spars would be available; they would indeed be far better landed at the dockyards on the outbreak of war.

There will be many ingenious methods used as defences against

torpedo attack in all future naval wars; their nature will depend entirely on the circumstances in which the ships are placed, and on the resources and ability of those who employ them.

As to torpedo-nets, we are of opinion that they are undoubtedly a most valuable defence against Whitehead attack, but they by no means render a ship invulnerable. To be fairly efficient they should be spread at least 30 feet from the ship's bottom, that is to give entire safety from a Whitehead that happened to explode in them. It is by no means sure that they will explode a Whitehead if its whisker is first removed, in which case the striving of the torpedo to get ahead will, before its motive power be expended, force the net close in to the side. If a Whitehead does happen to explode by striking a mesh of the net, the latter will be assuredly blown inboard, and a large space left open for another torpedo to get home. Instances have been known of the new and improved Whiteheads running at high speed¹ breaking clean through an ordinary torpedo-net.

It would seem preferable to attach the torpedo-nets to a row of buoys and boats moored well outside the ships rather than round their sides, lashing the ships, that is if they were in a well-sheltered harbour, close together behind the nets, in as small a space as possible, having in addition a well-organized protection of guard-boats and electric lights at the entrance of the port.

Any attack by larger vessels upon a net thus laid should be beaten off by launches armed with the spar torpedo; two or three launches thus armed being secured at either end of the nets with steam up and torpedoes fixed in readiness to slip at a moment's notice.

So satisfied are the French with their recent successes in China with the spar torpedo that they have made arrangements to supply all their war-ships with an increased supply of that weapon. Though we ourselves think the Whitehead of more value for most purposes, and more especially so for use against large ships, yet we amply recognize the fact that for all attacks on gunboats, gun-vessels, and vessels of shallow draught of water, the spar torpedo is the most suitable weapon.

The main point to our mind in connection with the prevention of ever recurring and perhaps successful torpedo attacks on our ships and fleets will be to take good care that those who make such attacks, whether successful or unsuccessful in their object, should be captured and destroyed. This, ironclads of themselves cannot always do, but their attendant torpedo-boats, torpedo-hunters, &c., should, if of the right sort and well found and equipped, be fully equal to the task. The prospect of performing dashing-feats, which will be open to the younger Officers of the Navy in the next war, has never at any period of our naval history been exceeded, and we are happy to think that we have both the Officers and the men who will be fully equal to their opportunities.

For a vessel simply to await and sustain torpedo-attacks wrapped

¹ Our torpedo experts think that soon the Whitehead will be capable of running at 30 knots' speed for 300 yards.

up in her nets like a hedgehog, or enclosed behind booms, or in "naval zerebas," like that constructed by our recent evolutionary fleet in Berehaven, is only to invite further and oft-repeated attacks; whereas after the clever destruction or capture of a dozen or so of torpedo-boats in the way we have propounded, we should hear far less, or perhaps none of that tall talk so freely indulged in by the inspired newspapers of a certain unwieldy foreign Power as to their organization of "pig sticking" and "hunting clubs," to be mainly constituted for the destruction of British armour-clads. It has frequently amused us to see how completely these papers thought they had only to send out their torpedo-boats at pleasure to hunt and blow up our armour-clads. With properly equipped torpedo-cruisers and torpedo-hunters the hunting might be quite the other way, and the would-be hunters and pig-stickers might in their turn find themselves the hunted.

We well know and respect the formidable powers of the automotive torpedoes, and we do not seek to underrate them; but we are convinced that they cannot be used in the same offhand way as agents to destroy our fleets as some other nations are pleased to imagine; and it seems somewhat unwise on their part to presuppose that we may not excel in their use afloat as greatly as we have done in the old days with the older naval weapons. We certainly and undeniably have far greater power to create a flotilla of fast torpedo-vessels in a hurry than any other nation, our only danger being the fearfully unprepared state into which we drift during time of peace through the observance of a thoroughly false and in the end expensive economy.

We think that the adoption of the rapid and "turnabout" torpedo-hunters proposed and constructed by Mr. White, of Cowes, will do much to lessen the terror which torpedo-boats have inspired; such a vessel as that torpedo-hunter, of which a plate is given in No. CXXIX of the "Journal of the Royal United Service Institution," page 483,² would make short work of our present 1st class torpedo-boats; her length is 150 feet; displacement, 220 tons; speed, 18 knots; while she will be able to turn in a little over her own length, carrying (in addition to her torpedo armament) a heavy armament of machine-guns; she, or vessels of her class, are likely to considerably influence torpedo-boat warfare of the future.

The smaller "turnabout" boats will also be invaluable as picquet and guard boats.

Our newly designed torpedo-catchers of the "Grasshopper" class ought, if their speed is good, to be, when attacking smaller torpedo-boats, veritable "Tritons amongst the minnows."

Ere we conclude this chapter, we would add a few words as to the future development of torpedo-vessels. The "Polyphemus" and "Scout" may be said to be advanced types of their class, but it by no means follows that they are to be the ultimate or sole representatives of highly developed torpedo power. Let us suppose, for instance, as an extreme case, that instead of limiting ourselves to the

¹ *Vide* certain Russian newspapers, 1878 to 1885.

² Commander Gallwey's valuable and interesting paper on "Torpedo Warfare."

2,600 tons displacement of the "Polyphemus," we built a torpedo-vessel of the same weight as the "Benbow," with her 10,000 tons actual displacement, and that we took away her armament of heavy guns, and confined her armour protection to a water-line belt and a heavily plated conning tower, giving her only a moderate armament of quick-firing and machine-guns, but fitting a discharge tube for a Whitehead torpedo wherever it was possible to put one, say at least eight on each broadside, two on either bow, two right ahead, and the same right astern. What we have gained in weight would allow us to give our proposed ship a seagoing speed of 20 knots, and if specially designed, better turning powers than the "Benbow." It would thus be within the power of our contemplated torpedo giant to close the "Benbow" at pleasure, when having done so she could discharge four Whitehead torpedoes to one of the "Benbow," but she cannot reply to the heavy armament of the latter, using in her attack only her machine-guns and torpedoes, then in the single combat of two such vessels the question is resolved into this: Is the superior gun-fire of the "Benbow" equal to the four to one torpedo discharge of her opponent? Which ship will be first able to sink or water-log the other?

The question is worthy of deep thought!

We distinctly wish to make it plain that in writing the above we do not advocate such a torpedo-vessel; on the contrary, we think it would be wiser to spend the same money in the construction of two "Polyphemus'," "Scouts," or other torpedo craft, but all the same, we feel that it is necessary for us to indicate a line of construction into which torpedo attack may yet lead us during its progressive competition with the gun as the naval weapon of the future.

We have not thought it incumbent on us to describe in any part of this essay how the Whitehead torpedo is discharged from boat or ship; there are various methods, such as steam pressure, hydraulic rams, launching carriages, &c. We shall not enter into any particulars of these, for we think that a small charge of slow combustion powder will be found in most cases the final and most effective method of getting the Whitehead away from its tube.

CHAPTER XI.—*Attack and Defence of Harbours.*

It has been claimed, and there is a good reason for this claim, that the recent advancements in the art of war have favoured the powers of forts and land batteries at the expense of the ships; meaning that it is not so easy for ships to bombard and destroy land defences now as it was in the days of the last four or five generations of mankind, whose ships, provided they could in sufficient force approach close enough to land batteries, hardly ever failed to give a good account of them.

Without any doubt it is possible to mount ordnance of unlimited weight and capacity in land batteries, it is also within the ability of the military engineer to protect guns on shore either in thickly

armoured casemates, in turrets, or in Gruson's cast steel shields of such immense thickness as to render them practically invulnerable to the gunfire of ships, in which, as we have already stated, the size and strength of both guns and plates will always be limited by weight; so that it is safe to say, that while the protection and armament carried by ships is ruled by the weight they can support with safety to themselves, in shore forts or batteries financial considerations will alone determine the extent of their strength and power.

Fortunately, however, for the ships it is quite the exception to find enough money lavished on land batteries as to render them the equal of the ships that could be brought to attack them; moreover another positive advantage always will remain with the vessels, viz., of being able to assail shore defences on their weakest points; by concentrating their fire on these, vessels may be able to overwhelm land batteries in detail. It is manifestly impossible for any nation to fortify efficiently every port and town on its littoral, it is also a fact that tells much in favour of the ships, that in this era of rapid progress, the short lapse of even one decade will render the guns of to-day, and probably the forts in which they are mounted, comparatively obsolete, and experience teaches us that most nations are very slow in securing their constant renovation by reason of the great expense that it entails.

We feel, therefore, justified in assuming that with the exception of certain large naval stations and seaports, whose importance renders their protection a matter beyond monetary consideration, as far as guns and plates are concerned, ships of war, as we now know them, will be nearly always found the masters of shore defences.

We are, however, by no means prepared to say that this state of things will continue in the future; on the contrary we think that as the value of high speed incidental to the use of the ram and the torpedo becomes, as it will, more apparent, the tendency of naval constructors will be to reduce the weight of armament and protective plating carried by ships, and so obtain more speed; we even go so far as to again express what we have before hinted; viz., that it will be found in the future that small and swift vessels combined in great numbers are potent to destroy the colossal armour-clads of to-day. If this be so, then the war navies of the future, consisting mainly of swift vessels fitted with ram and torpedo, of fragile construction and of very light gun armament, will be quite incompetent to engage land batteries, and should not attempt to do so.

These vessels would be used alone to secure the national supremacy afloat, and having secured it, they should when necessary escort slow but heavily armed and protected floating batteries to within range of the guns of the enemy's forts, and leave them to do the work of bombardment, keeping near the floating batteries in readiness to protect them in case the enemy should send out a sortie of rams and torpedo-boats.

Floating batteries could be quickly constructed in time of war and guns and plates of great thickness could be mounted on them; we do

not believe in the necessity of our keeping a force ready at all times to bombard the *coasts* of our possible enemies; what we do want is, the necessary vessels to secure the command of the sea on the first outbreak of war; having secured this, our great and unequalled naval resources could be vigorously developed in any desired direction.

We have not forgotten that the matter of the essay does not require us to go deeply into the subject of the gun attack and defence of ships *versus* forts, but we find now, as we found in a previous chapter, that it is simply impossible to make any very distinct separation of the various means of attack and defence which will be employed in this or any other branch of future naval warfare; for guns will be employed whensoever it is possible to do so for the protection of all submarine mining defences, and the mines themselves, by keeping the ships at a distance, give an immense amount of protection to the guns; being thus mutually of so much assistance to each other, we may assume that the co-operation of guns and submarine mines is most essential to any thorough system of harbour defence.

It is indeed well for the harbours of our possible foes that the submarine mine has become of such dread repute as an engine of maritime war, and that its use has, as far as our present ships are concerned, commanded such a wholesome respect for its powers. It has indeed almost become a maxim among seamen that it is their duty not to heedlessly risk their vessels in close proximity to submarine mines: if this were not so, in these days of high speed and protective armour there would be nothing to prevent any fast vessel with a daring Captain from running the gauntlet of the hostile batteries at the entrance to any port, or rapidly steaming into a gun-defended roadstead, and then when once in, either sinking with her ram any victim she chose to select, or at her pleasure literally "running amuck" amongst the whole of the shipping which was therein sheltered: a vessel like the "Polyphemus" would be well suited for such an exploit.

But where the presence of submarine mines is either known or suspected, and no matter whether the mines are mechanical or electro-contact, to attempt such a feat would be foolhardy to the last degree, and unless accompanied by the most extraordinary good luck, could only terminate in disaster to the attacking vessel.

We apprehend that whenever a fleet is stationed to blockade, with orders to subsequently attack the defences of a hostile port, the Admiral in command will first cautiously obtain any information he can get as to its submarine mine defences; should he find that there is a well-laid mine field placed under cover of heavy guns, then he must pause and take varied and most troublesome measures to make sure of removing or destroying the mines before hazarding a single large vessel in an attack on the forts. Even if a large proportion of the enemy's mines are reported to be dummies, yet the moral effect will still be great, and every precaution for their removal must still be taken.

We may assume then that the future defences of great seaports will

embrace, in addition to heavily-armed forts with turret and shield-protected guns, an extensive system of electric submarine mines; these should be backed by a flotilla of armed torpedo-boats fitted to use the Whitehead or the spar torpedo. The electric light will also be utilized to throw by night its rays over the mine field and the approaches to it; under such conditions, the work of removing or destroying the mines would be a labour of great risk and difficulty.

But all harbours will not be so effectively defended as the above; often in the less important harbours the defences will be limited to guns alone: more often from force of circumstances it will be a system of submarine mines alone that is relied upon to keep the enemy out; even occasionally the port may be only defended by torpedo-boats and gun-vessels; or its entrance may be simply barred by booms or other obstructions, vessels sunk in the fair way, &c.

The "Lay," or the "Brennan" or some other controllable automotive torpedo may also form a part of the land defence against attacking ships, and if the published reports as to the successful experimental trials of the "Brennan" are to be believed, attacking ships will be in much jeopardy from these torpedoes even at a distance of two miles.

The amount of defence afforded by the different systems we have mentioned may be briefly summed up as follows:—

Against a gun defence unsupplemented by submarine mines or automotive torpedoes, the attacking ships can at pleasure, provided the water be not too shallow, measure their strength against the shore forts or batteries, continuing their bombardment or ceasing it at will. We have of late years had several well-marked examples of this kind of attack. We name for instance our attacks of 1854 and 1855 on various Russian seaports and fortresses, the American Civil War; also the Spanish bombardment of Callao, and later, the destruction of the forts at Alexandria.

Against the defence offered by a well-planned system of submarine mines, no rash attack can be attempted. On the contrary, cautious preliminary arrangements must be adopted to ascertain by what system of mines the place is defended, and how and where the mine fields are placed; then every endeavour must be used to clear a channel for the safe approach of the ships by destroying or removing the mines. This will become an affair of careful details, such as creeping for and cutting the mine connections or moorings, countermining, &c. All work of this kind must be performed under the close supervision of well-trained torpedo Officers and men. Where the mines are placed under cover of batteries, these proceedings are not possible except at night or during thick weather, and even then smooth water and no tides are necessary adjuncts to success.

No attack should be made by ships on a port so defended, unless the attacking fleet were sure of their naval predominance; a defeat with the loss of several ships sunk by mines might lead up to further and more serious disasters: a blockade will have to be enforced.

In the blockade of a port, the ships that compose the blockading fleet will always be at a serious disadvantage when compared to the

blockaded ships. Amongst the arduous duties of a blockader, constant coaling will be the most serious. Steam will generally have to be ready for full speed at a few minutes' notice, and yet all boilers must be kept with tubes well swept and clean. It seems advisable that the ships which form part of a blockading squadron should be docked at least every three months so as to prevent a foul bottom diminishing their speed. The career of the Peruvian "Huascar" was terminated by the Chilean ships "Blanco Encalada" and "Cochrane," solely because the repeated requests of her Captain to have his ship docked and her bottom cleaned were refused by the Peruvian Government.

Blockading work is the most severe duty that can be imposed upon a seaman. He certainly may not have to endure such prolonged absence from his native shores, or from the pleasures and comforts of the land, as his forefathers had in our wars of not a hundred years ago; but the application of steam and the introduction of the ram, and the increasing power of swift torpedo-boats, the worries of the telegraph, &c., will not fail to cause him endless anxiety, and will require him to exert an unceasing vigilance, so much so as to demand from him an exercise of nerve and brain power to which, happily for themselves, his ancestors were perfect strangers.

We do not think it advisable that any of our systems of placing submarine mines for defensive purposes should be discussed in this or indeed in any essay. We are, however, justified in observing that all our present experience goes to prove that any system of mines to be effective at first, and to preserve its effectiveness afterwards, must not only be planned but placed in position by trained experts, and also that the best materials and most perfect workmanship must be used. Extemporized mines and inferior insulated wires, combined with unskilled workmanship, can never lay out either an effective or a durable submarine mine field. All the materials for defensive mines should be leisurely and carefully prepared and tested in peacetime. It is true that mines can be extemporized and laid down from ships at very short notice, but if made of casks or oil drums, their effective under-water existence is a short one; in a few days, or perhaps in a few hours, the penetrative and searching qualities of the sea water will have found out not only the weak places in the mines, but any faults in the insulation of their wires; while tides, winds, and currents will at the same time unceasingly do their best to injure or shift them. Mechanical or self-acting mines may be improvised more quickly and with a better chance of success than electric mines, but when laid they are dangerous and obstruct the navigation alike to friend and foe, and as for picking them up again, it would be a service of infinite danger. A great rise and fall of tide, and the consequent rapidity of current is a serious impediment to the proper laying of mines, not only from the difficulty of moving them, for it will be no use to have all one's mines bobbing up to the surface at low water in full view of the enemy, or even if they do not actually appear, yet the "twirl" caused by a swift current running over a mine near the surface will always reveal its position. We under-

stand that this great and apparently unsurmountable difficulty of making mines keep their proper depth has been overcome by the ingenuity of an Austrian Officer, and also by one of our own torpedo Officers; but their plans are unknown to us, and if we knew them, it would not be our place herein to record their secret any more than it would be if we were to explain the entire mechanism of the Whitehead torpedo. Ground mines may be advantageously used in shallow water, they are not liable to drift or shift their position, are very hard to discern and pick up, especially if silted over with deposit. Submarine mines have also been fixed on the ends of stakes or posts driven into the bottom. The Confederates made good use of this plan of fixing mines in the defence of their rivers against the ships of the Federal States.

Translucid water, such as we meet with in some tropical and sub-tropical waters, would be a great drawback to effective submarine mining, the mines could be easily seen by the aid of water glasses, then carefully grappled and removed by the enemy; an observer stationed aloft in a ship with the sun at his back could detect them by eye alone well in advance of the path of his vessel.

There are many and various methods of clearing a channel of submarine mines, but little has been done in this way in actual warfare; in practice, boats have swept the bottom with weighted hawsers, and so got hold of the moorings of the mines, or the torpedo "Detector" can be slowly towed by a boat along the bottom, and which, acting somewhat on the principle of the telephone, will make a buzzing sound in the receiver whenever the detector is close to any metal; or they have by creeping fouled and cut the electric communication, &c. But in actual warfare, when live mines have to be handled and not dummies, countermining will be found the safest and most effective means to destroy or remove the enemy's mines. A boat will be sent in, perhaps automatically, over the mine field of the enemy, to lay down a good sprinkling of electric countermines, these mines will be dropped, and on the return of the boat exploded; the water space or channel so cleared will be then carefully buoyed and the process repeated farther on; the heavy countermines will explode or render useless the mines of the enemy for a considerable distance on either side of the explosion; this service must of necessity be always a very hazardous one, and could not be performed under fire.

We have already stated that we believe a special ship will be constructed to assist in clearing channels of submarine mines. She will be built of low speed but of the greatest possible strength, the outside skin of the hull being perhaps 2 inches in thickness, with an extensive double bottom and numerous watertight compartments and subdivisions, the boilers and machinery being kept well within the centre of the vessel; in Diagram, Fig. XVII, we represent a rough plan of such a craft at the water-line. From her sides just above the water she should carry nine or more arms or spreaders made of mild wrought steel, these should be connected with each other and fitted to lower to a depth of 15 or 20 feet, or if necessary top up out of the water, and be supported by chains attached to stout posts or stanchions

fixed on her sides; each of the arms or spreaders should have a stout sharp-edged hook at its extremity capable of catching or perhaps severing the moorings of any submarine mine that it happened to foul, the arms of the spreaders should be well fitted and be movable and adjustable, so that those injured by an explosion could be replaced; spare arms should be carried inboard. A vessel of this type would no doubt be expensive, and she would be useless except for the special service on which we propose to employ her; she will be only one more example of the motto which is now so applicable to ships and vessels of war, "*Non omnia possumus omnes*;" where, however, it was necessary to force a channel leading to the attack on a seaport, and which passage must be quickly cleared of submarine mines, as constantly was the case in the American Civil War, expense would be a very small consideration; to get quickly at the enemy would be the one and only object; here we say, in a case of this kind, that our proposed "*Removes*" might render essential and valuable service; steaming slowly up and down the suspected locality of mines, those fouled could be removed or exploded or brought to the surface at a fairly safe distance from her hull.

Booms or chains moored across the entrance to a harbour can only be regarded as an expedient available against the attacks of torpedo-boats, which undoubtedly can be stopped by such a defence; but a larger class of vessel would have no difficulty in breaking through any boom however strongly it might be moored. The experimental boom at Berehaven proved that the yards and spars of ships are not well suited to form an effective boom, large logs of wood with deep grooves let into them to secure steel wire hawsers in would be much more serviceable, and would have to be provided for the defence of any harbour to which the ships of a fleet resorted to shelter themselves against the night attack of an enemy's torpedo-boats.

Probably two booms, one light and the other heavy, the light one on the outside, are best suited to prevent torpedo-boats from jumping them; the small boom will check the boat's speed, having lost this, she will be unable to regain sufficient impetus to clear the inner and stouter boom.

All sorts of floating obstructions, such as nets and grass ropes, are valuable adjuncts to stop a torpedo-boat attack on ships which were sheltering in a harbour. No boom can stand the charge of a heavy ship.

The offing of a blockaded harbour will be the constant witness of many torpedo-boat sorties or cutting-out expeditions, and in this way we may depend that both blockaders and blockaded will continually worry one another. Attacks of this nature should be well suited to the abilities of our naval Officers and seamen; it is well within our power to daily scour the English Channel with torpedo-boats and torpedo-cruisers should the stern necessities of war ever render it necessary for us so to do. We have only to read any of our naval histories to see what an immense amount of work was daily done, and what gallant deeds were performed in the schooners and cutters which were so fearlessly handled by our ancestors in the days of old, to gather what

their descendants may do, if they have not degenerated, in small swift vessels, and in which they will secure all the advantages due to the almost absolute certainty attending their power of locomotion, instead of, as was the case of old, waiting for days inactive through the fickleness of the wind, or perhaps drifting helplessly becalmed when speed was most needed.

Up to the present moment we have in this chapter confined ourselves to dealing with the attack and defence of harbours in the sense that it will be generally unadvisable for ships to risk destruction among the submarine mines off the ports of an enemy; but we have not forgotten that at times it may be strategically necessary for ships to force a passage or attack a harbour, freely taking all risks; often the importance of the results to be derived from the capture of a place may justify an Admiral in hazarding the destruction of a large proportion of his vessels. Let us say, for instance, that it was necessary to force a passage up such rivers as the Mersey, Severn, or Clyde, and that if this could be done, the enemy might be compelled to sue for peace, and a prospect would be afforded of bringing a severe war to a speedy termination; it was at one time necessary for Farragut to steam his ships through or over a Confederate submarine mine field, and he did so. We may be sure that the same thing can be repeated, but it will be more costly now than it was then. Preliminary to an attack of this nature we may be allowed to suppose that an Admiral would reckon what ships he could best afford to lose, and would advance them to almost inevitable destruction, or possibly a number of hired merchant steamers may be sent on in front of the fleet manned by volunteers as a sort of forlorn hope, with orders to steam on in advance of the fleet, not stopping or turning to avoid the most certain indications of the proximity of submarine mines; or possibly the ships of war may be themselves lashed together in pairs; or more possibly a merchant vessel filled with empty casks may be lashed on each side of a man-of-war with the view of exposing them to the first brunt of a torpedo or submarine mine explosion, and to make sure of the man-of-war being able to still get ahead if her motive power were disabled. What matter if, in such a case, the sides of the merchant steamers were blown in, they could be cast off and abandoned, the object sought would be gained if only a fair proportion of the men-of-war got safely past the mines; it might then only remain for them to make their own terms for the ransom of a big city.

We have said that it is impossible to give adequate protection to every town, port, or harbour on our coasts; nor is it possible for the littoral of any country that we know of to be wholly defended by a combined system of forts and submarine mines. It will be almost equally impossible in our own case to provide for the defence of our numerous small seaports, fishing towns, and villages, by submarine mines alone, or by guns alone; mines may be used to protect the most important mercantile and fishing towns, but cannot be extended to such a distance from the shore as to preclude the ability of some hostile cruiser lying off and bombarding the place; guns may be placed so as to prevent the enemy from landing, but the cost of

mounting guns in sufficient numbers to command all approaches would be more than any nation could afford; many of our wealthiest watering places are actually on the seaboard with an open and extended sea frontage; it must be the joint labour of our most able, skilful engineers and naval Officers to decide what system of defence is most applicable to each place.

Those large towns of ours then which are actually situate on the seashore and have extensive deep water approaches cannot rely entirely on either guns or mines for their defence, they must seek protection from the Navy; gun- and torpedo-boats must be their "défense mobile." Other places which are situated further in shore, and many of which have narrow tidal harbours, might obtain a fair protection from a well-laid system of submarine mines. It is clearly impossible to propose any general system of defence that would be equally applicable to all and every place; but it cannot be denied that in time of peace it would be highly advisable to have a well-trained torpedo volunteer corps at every seaside place of the least importance; then whenever the country unfortunately became involved in a maritime war, the trained ingenuity of these men might improvise and lay down a torpedo defence for their town, which even, if ineffective, would all the same be so morally deterrent as to prevent the over-confident approaches of hostile vessels.

Personally we can never persuade ourselves that the defences of our smaller seaports should be other than a powerful war navy, a navy so strong as to defy aggression on the part of other Powers; but if our countrymen are unwise enough—as indeed they are—not to see as we see it, then of course it is undeniable that local defences should receive every attention. Nevertheless, having done all that can be done in the way of local defences, we feel assured that it will be a sorry day for England when the people of another country are strong enough at sea to attempt the attack of our littoral and seaboard, and it will be a sad confession of our naval impotence when we in our defence have to fall back on forts and submarine mines to frustrate their assaults, instead of doing as we did in our brave days of old with our ships carry the war on to a foreign coast.

Steam has placed a large section of our coast within a few hours steaming of the harbours of populous towns and powerful nations, but it has equally placed their coasts within easy reach of us; in the event of war between them and ourselves, the safety or unsafety of the various ports on either coast would much depend on the aptitude with which high speeds in both ships and boats, and the uses of locomotive torpedoes and submarine mines, have been studied, realized, and acquired by the Naval Services of the conflicting countries.

CHAPTER XII.—*General Summary and Conclusion.*

We venture to think that it will be well if, before concluding this essay, we should briefly summarize the results that we have striven to indicate, or which we have dealt with in our previous chapters, and which are, in the main, entirely due or consequent on the introduc-

tion of the ram, the torpedo, and the submarine mine as naval weapons; by so doing we shall tersely present our opinions and ideas to the consideration of those who have, perhaps, not the leisure to follow us through the whole of our preliminary arguments and reflections.

It will have been sufficiently obvious to those who have been indulgent enough to read what we have written, that for the present we indicate the ram as the leading naval weapon for fleet actions; we say that it is most essentially so, and that in their opening charge with the ram, artillery will have to be subordinated to its use! For other actions it has also in a great measure rivalled or surpassed the gun, but it may, nevertheless, itself have eventually to yield to the torpedo, which latter, oddly enough, while it also appears likely to beat the heavy gun, yet brings the employment of lighter quick-firing and machine-guns most prominently to the front.

For the actions of single ships the ram may perchance be inferior to the gun, and only hold about the same relative value as the locomotive torpedo; but in accepting this doctrine we must remember that even if the whole of the guns of a vessel are silenced early in an action by the superior gun-fire of an enemy, who may have knocked her hull to pieces above the water-line, yet so long as speed and steering gear are left intact, this vessel is not by any means beaten, still less captured, and she may even yet find an opportunity to sink her enemy with the ram or the torpedo, which latter may be to some extent regarded as a flexible extension of the ram.

Arguing from the above, it is evident that the existence and potency of the ram and the locomotive torpedo demand that the water-line, steering gear, and conning-towers of ships should absorb all the protection that can be afforded them; also that the ram itself, and the bows of all vessels, more especially of fleet or battle-ships, should be very strong and of the best possible construction and formation, both for making and resisting ramming attacks, and that their instalment of locomotive torpedoes should receive every attention.

Thus we hope to have demonstrated that next to the ram we regard the locomotive torpedo of the Whitehead type as a leading and potent naval weapon, a weapon with a great and almost unknown future before it, and now the weapon *par excellence* for the attacks of small vessels upon larger foes; and also as a weapon that in single-ship actions should give great results; but in fleet actions we would make its use always secondary to the use of the ram, especially in their commencement, when its general employment should, like the guns, be carefully restrained.

Locomotive torpedoes of all descriptions have united to abolish the almost absolute security that in the days of old our battle-ships were justified in arrogating to themselves; now all large vessels, more especially when they are assembled in fleets, must use increasing vigilance to prevent themselves from becoming the subject of those attacks which will at once place them at a decided disadvantage with their assailants.

Then individual perfection and similitude of type being impossible, future naval warfare will insist on the use of vessels differing greatly from each other; without this co-operation there can be no absolutely efficient naval force, the ram and the torpedo-vessel must supplement the battle-ship, which in her turn must be their base of operations. It is necessary for the very safety of every battle-ship that she should have a due proportion of swift satellites attached to her.

Large and costly ships, despite their immense fighting powers, must yet be constantly watched, guarded, and surrounded by scouts, torpedo-hunters, and picket-boats; for it is proved beyond dispute that these costly ships cannot, if unaided, protect either themselves or each other; while at night they are liable to instant assassination.

Here we have, from this cogent fact, provided we choose to follow it to a greater length, forced upon us the extreme probability that the experience which may be gained in future naval warfare will totally and radically alter the entire composition of our fleets as we now constitute them; it is indeed, as we have already said, irresistibly certain that the assortment of a war-fleet must be most composite in its character, the old array of battle-ships formed in several ranks will be only the nucleus on which to form more numerous vessels of a great diversity of type, form and power; we are not, indeed, prepared to say with any certainty how much longer the necessity for such a nucleus, or the material for forming it, may be suffered to exist. Already the battle-ship of our day is hard pressed, and it is openly confessed that her ancient potency is now half imaginary.

The naval might of a nation cannot in these days be alone reckoned by the number and size of its battle-ships; on the contrary, due regard must be given first to its personnel and then to the numbers and the efficiency of its rams, torpedo-vessels, torpedo-boats, torpedo-hunters, and fast scouts and cruisers. Speed—and then more speed, will be the constant cry of the seaman to enable him to make good or resist the attacks of the torpedo.

In close connection with the above, it is indelibly impressed upon our mind that far greater facilities should be afforded our naval Officers and seamen of becoming expert in the use of the ram and the torpedo. The art of manœuvring a vessel in all its bearings on the accomplished use of these weapons should form a large portion of both the theoretical and practical knowledge that we seek to impart to our young Officers, and it should form an important item in all their tests and examinations.

We believe that automobile controllable torpedoes are destined to take a large place in the future defence of ports and harbours; if so, and they be found successful, they will be the last nail in the coffin of the monster battle-ships of to-day.

It is palpable to all of us—at least to those of us who have given any thought to the subject—that the extended employment of torpedoes and submarine mines enforces the use of electricity in a hundred ways; whether it is wished to explode the submarine mine from the shore, or to discharge the heavy gun or the Whitehead from the ship,

fired perhaps by an Officer placed aloft in the top well above the smoke of the battle, in each and every case it must be done by electricity; to leave unsaid the manifold advantages of electric lighting and electric telegraphy in future naval wars would be unpardonable; hence it is most urgent that practical electricity should take a foremost place among those manifold studies that are necessary to the naval Officer.

Truly remarkable is it how all our ideas and reflections in regard to the changed conditions of naval warfare go, one and all, to prove that the naval Officer of our time must be amongst the most highly educated of men; we find that any one of the various studies and numerous subjects that are forced upon him are usually regarded as quite sufficient in themselves to form the entire profession of another man; and with all this our naval Officer has to acquire much of his knowledge under circumstances that are highly prejudicial to severe study. If this were sufficiently recognized, we think that further efforts would be made to relieve the embryo naval Officer from devoting so much time to those professional subjects which are rapidly becoming obsolete—and there are many—and so give him a better chance of acquiring that which is an actual necessity to him. We must also more fully recognize than we now do that these are the days of specialists, and so not expect our naval Officers to be, every one of them, perfect all round in the scientific branches of their profession, but giving certain men, who exhibit well-marked aptitude for special branches, every opportunity to perfect themselves in them, perhaps to the partial exclusion of some others.

We think that it is proved beyond all controversy that the necessity exists for having in these days special ships for special purposes, and further proved that the old-fashioned plan of having all vessels built on one model, but of differing sizes, and proportionately varying gun armaments, has gone never again to return; even so, specially trained Officers and men are now wanted for special ships and special purposes, and for which, if they are to be successful, they must have previously undergone a severe and preponderating course of professional training.

It will be no fault of the Officers themselves if they do not obtain such knowledge; there is, we are sure, a far greater tendency on their part to apply themselves to the acquisition of anything that is novel in their profession than there is readiness on the part of our rulers to grant the funds which are necessary to assist them in its acquirement.

CONCLUSION.

To us it is curious at all times to observe the vehemence with which our political free trade partizans deprecate a tax upon imported corn, strongly protesting at every opportunity against the imposition of what would be merely a nominal tax on any of our food supplies. They even go so far as to advocate that if necessary it is better that our farmers should face ruin, and that our agricultural population should from lack of work be driven into the workhouse or else to

emigration, anything in fact, so long as the manufacturing masses of our countrymen are enabled to buy a cheap loaf. Now it is no part of our essay either to laud or condemn such a policy, and we have not the slightest intention of doing either the one or the other, but all the same it is well within the scope of our efforts to point a moral from the earnestness of their contentions; to do so we would merely ask whether our consistent free trade advocates, or their political opponents the fair traders, have ever seriously concerned themselves as to what the price of wheat would be in England if our fleets were vanquished and our great trade routes even momentarily interrupted?

Do they rely on the Declaration of Paris, or on any special treaties of commerce? If so, we ask again, have they any good reason for doing so?

Only quite recently the French declared rice to be contraband of war: what is to prevent wheat from being similarly proclaimed, if the stern necessities of war, which knows no bounds and can be restrained by no treaty, should ever require it? What a direful prospect this opens up for our beloved country! There is positively only one remedy short of universal peace and the millennium, and that is, that England, as we know her, must at all costs and at any present sacrifice determine to retain the command of the seas.

We have done our best to demonstrate that the solid basis of good seamanship incidental to the skilful management of vessels under canvas, by reason of which our naval supremacy was established, has been cut from under our feet, and we have endeavoured to point out the exceeding uncertainty that must attend future naval wars, owing to the general employment of the ram, the torpedo, and the submarine mine, as well as to the departed omnipotence of the line-of-battle ship, under whose sheltering bulwarks our country has acquired so many glories and inherited such vast prosperity. To meet this uncertainty as far as possible on the safe side, it is more than ever necessary that Great Britain should at all times possess an adequate war fleet, manned by a highly-trained personnel, well equipped and ready at any moment to take up, on the very outbreak of war, all the arduous duties that would be imposed upon them. We cannot, alas! say that at present our fleet is in this satisfactory condition. But ready or not ready, adequate fleet or inadequate fleet, let those of us who love our country, and who are proud of her glorious history, being still hopeful of the destinies of our race, one and all in Her Majesty's Royal Navy, remember the last and most memorable signal of our greatest naval leader, and be prepared to do our duty.

Nº VI.

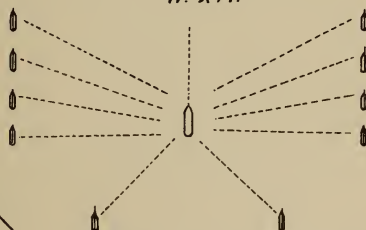
Fleet A.

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Fleet B.

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Nº XVI.



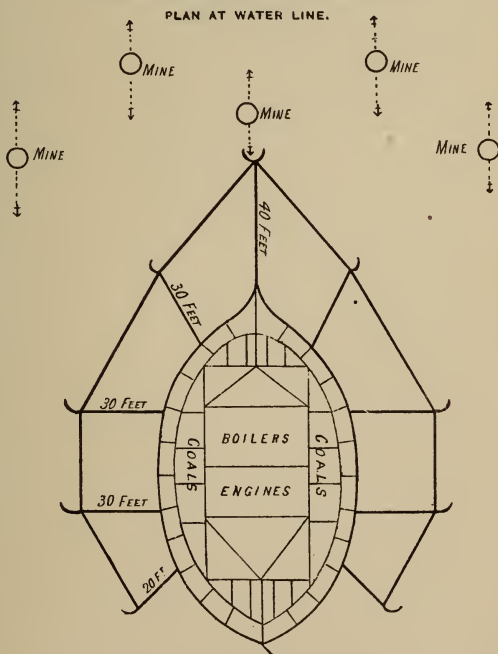
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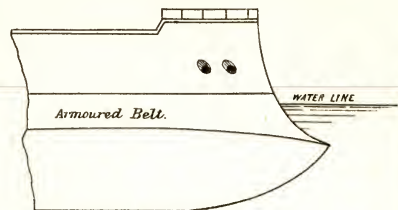
ROUGH DRAWING OF PROPOSED SUBMARINE MINE REMOVER.

PLAN AT WATER LINE.



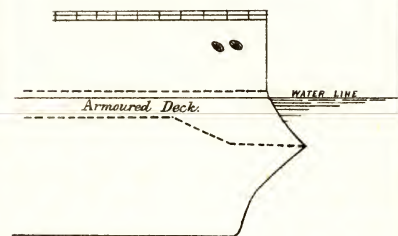
Nº I.

THE RAM, FRENCH TYPE.



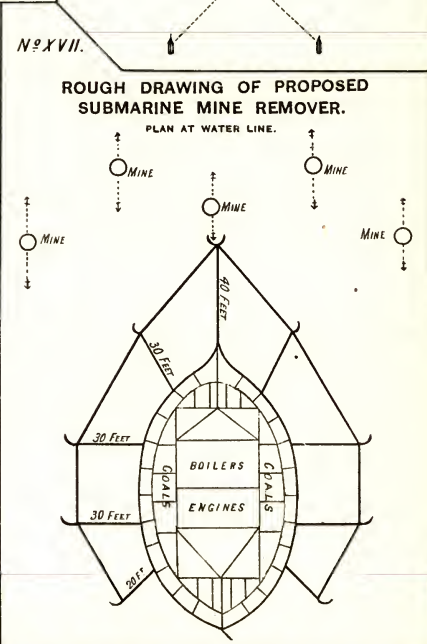
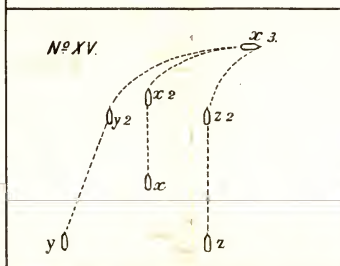
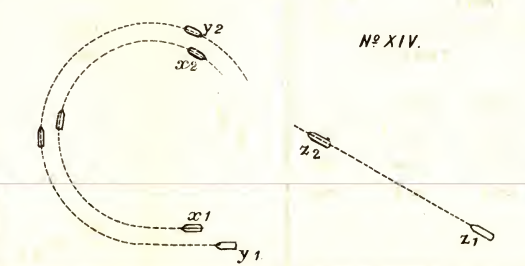
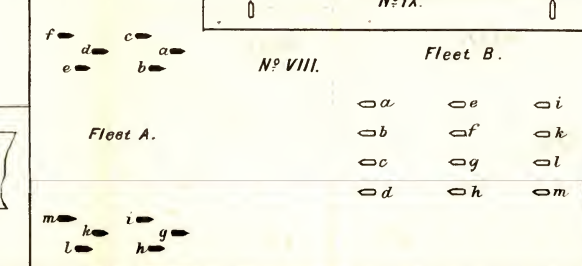
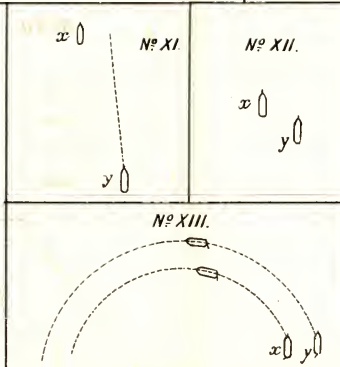
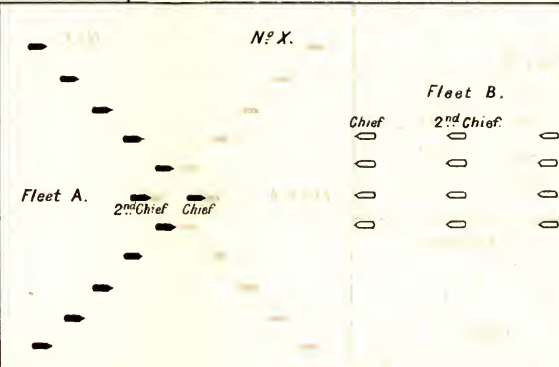
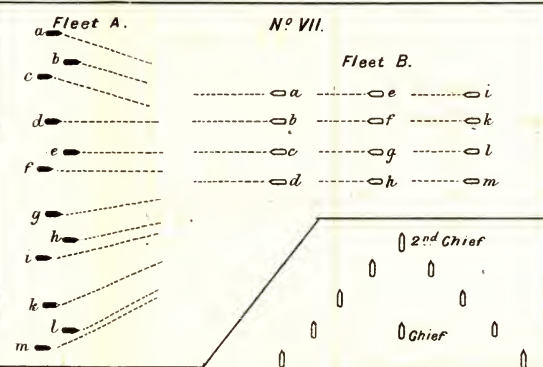
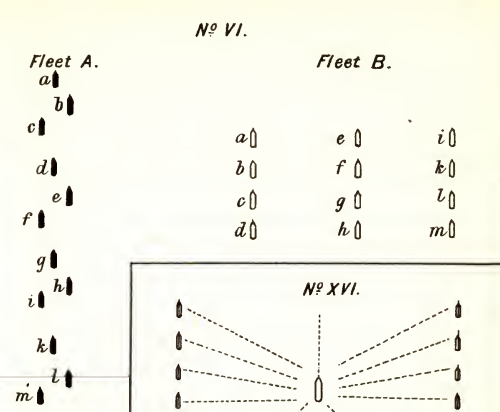
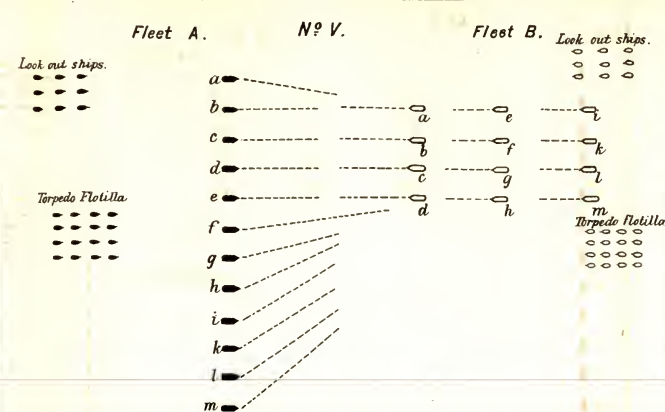
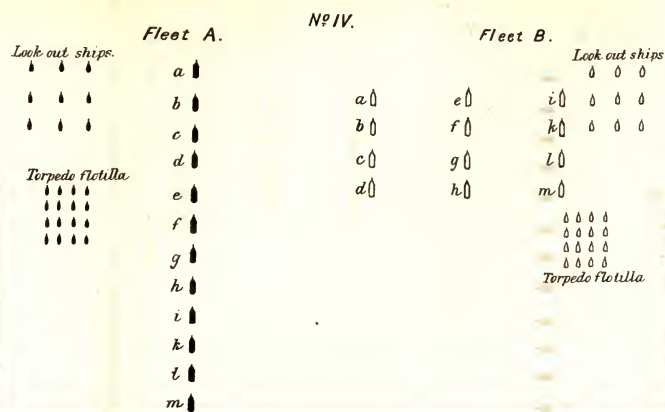
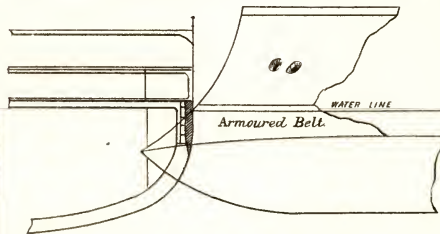
Nº II.

THE RAM, ENGLISH TYPE.



Nº III.

MIDSHIP SECTION, PIERCED BY RAM.



Friday, March 19, 1886.

GENERAL J. T. WALKER, C.B., F.R.S., &c., Member of Council,
in the Chair.

THE WELDON RANGE-FINDER.

By Colonel J. B. RICHARDSON, R.A.

UNTIL the fire of infantry and artillery approached something like accuracy, instruments which would indicate with precision and speed the distance of the object aimed at were unnecessary. For some years past the artillery, however, have been aware of the immense increase both in the moral and actual results of their fire when the range is known beforehand. It is true that they can make use of trial shots, but the judgment of the unaided eye is singularly incorrect when estimating the position of even so distinct an object as the burst of a common shell at a moderate range, while the strike of rifle and machine-gun bullets is in most cases indistinguishable. As a consequence, artillery have been the first to welcome each advance in range-finding, and the earliest steps towards supplying the want felt came from that branch. The range-finders first introduced into the Service were the inventions of two artillery Officers, Nolan and Watkin, and these still remain Service instruments.

Infantry were trained mainly to shoot at targets on well-measured and marked ranges, and as a consequence did not so soon recognize the want of an accurate range-measurer as did the artillery, whose batteries, especially in India, seldom used targets on measured ranges, and more frequently practised at gun-pits, shelter-trenches, and dummies at unknown ranges. The development of field-firing has, however, led to the demand for a trustworthy and handy range-finder for infantry, and the new Service instrument which I bring before you to-day comes from the infantry. It was the want of a range-measurer adapted to the wants of his branch of the Service that primarily induced Colonel Weldon to turn his attention and ingenuity to the invention of a variety of instruments which have resulted in the simple range-finder before you, which is excellently adapted for the field work of both artillery and infantry. While simple, rapid, and accurate in working, it is capable of standing the very severe tests of varying climates, and of the rough usage inseparable, at any rate with mounted corps, from the use of a range-finder in the field.

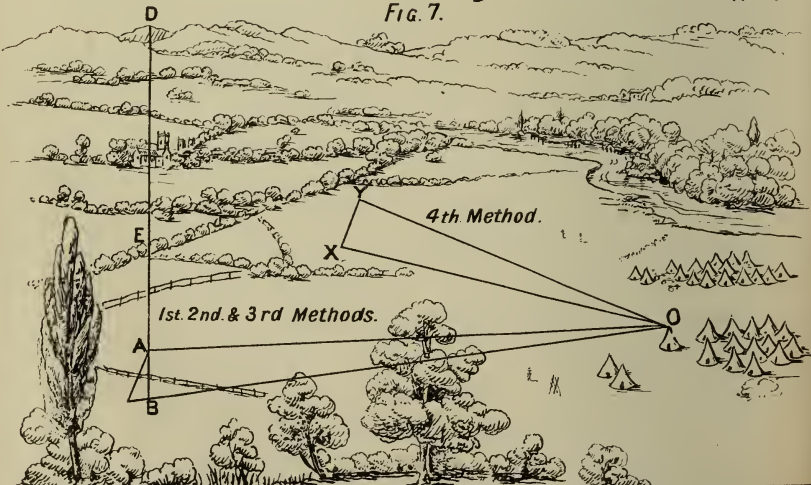
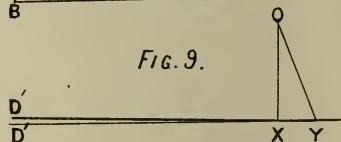
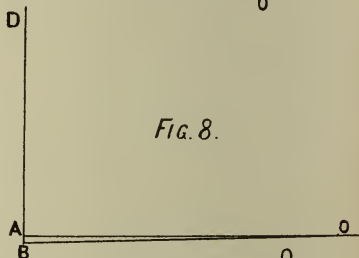
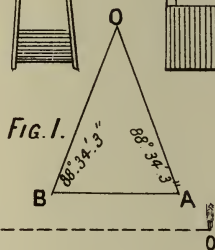
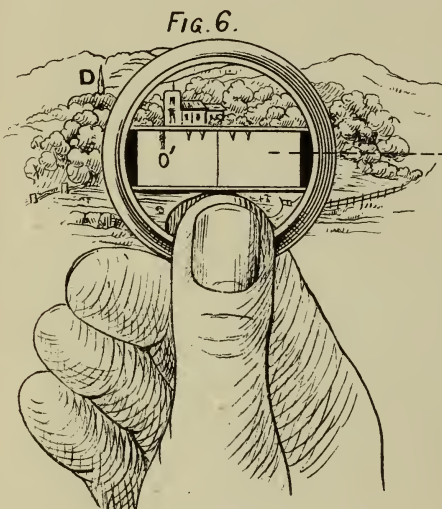
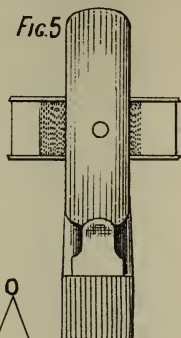
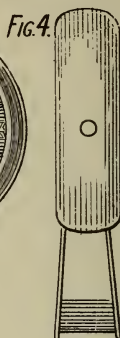
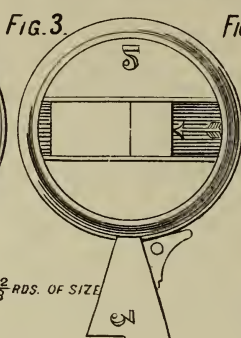
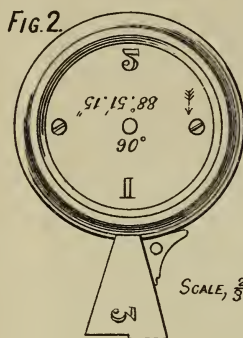
An early form in which Colonel Weldon brought forward his range-finder deserves passing notice. It was something in the nature of an optical square, the glasses, however, being set at an inclination to reflect an angle of $88^{\circ} 34' 3''$. The instruments were remarkably accurate, easy to use, and possessed the desirable capacity of finding the range of moving objects with very considerable precision; the distance of the puff of smoke from a rifle was fairly accurately told by their use. There were many methods of using them, but the general system can be easily understood by a reference to Fig. 1, where an observer A, moving to his right or left, reflected the object O on B; the angle $OAB = 88^{\circ} 34' 3''$. The observer B moved forward or backward on the line BA until he saw in his glass the object O reflected on A; the angle OBA being also $= 88^{\circ} 34' 3''$. An isosceles triangle was thus formed, of which the base was to either side as 1 : 20. The base was generally paced, which was found to yield sufficiently accurate results, but it was measured if extreme precision was required. Ranges were found by trained men with remarkable rapidity, ease, and accuracy with these instruments, and they were very portable; but, while they were void of most of the defects of the Service range-finders and were effectively used on service in Afghanistan, they possessed two defects in common which appeared to their inventor to render them imperfect, viz., they could get out of adjustment, and the glasses were affected by climate. They did not easily get out of order, but were decidedly difficult to readjust if they did.

The present Weldon range-finder combines all the advantages of these early inventions, while it is free from their defects, and possesses many merits peculiar to itself. Short of getting crushed, it cannot get out of adjustment, and the silvering difficulty has probably been overcome. Exposed to severe tests, none of the new prisms have shown signs of deterioration. Figs. 2, 3, 4, 5 are representations of the instrument in various positions: you can see that it is very portable and very simple.

It consists of three triangular prisms of a specially-made hard crown glass, entirely free from blemishes and striæ. The prisms are silvered on one side by precipitating silver from a solution on the glass, varnishing, and further protecting them with several coats of a special paint, or by a layer of copper electro deposited on silver. The prisms are cemented to the frame with a cement that is impervious to damp; but even supposing the silvering destroyed it could be removed altogether and the prisms would still reflect. The two larger prisms are cemented to a bar between two circular discs of thin metal, forming what has been termed the "prism block;" and the smaller prism is similarly fixed in the handle of the ring case, in which the prism block revolves on pivots. In addition to the cement the prisms are secured from movement by small pins. The case ring, block, &c., have been made of various metals and sizes, ordinarily they are made of brass and are browned.

Colonel Weldon had extreme difficulty in getting the prisms made with accuracy; not only must the apex angle be true, but one of the base angles must be exactly half that angle, and therein lies a

WELDON RANGE FINDER.



difficulty. Their present perfection is the result of patience, perseverance, and costly experiment. Optician after optician, both in England and on the Continent, undertook to make them accurately, but their attempts resulted in constant failure. The method now adopted is a secret.

The angles reflected by the prisms are respectively—

| | |
|-----------------|-------------|
| 1st prism. | 90° |
| 2nd „ | 88° 51' 15" |
| 3rd „ | 74° 53' 15" |

The first two are the angles at the base of a right-angled triangle, of which the perpendicular is to the base as 50 : 1. The third with the complement of the second (viz., 91° 8' 45") are angles in an obtuse-angled triangle, of which the side subtending the angle 74° 53' 15" is to the base as 4 : 1.

In prisms of this nature, if the apex is other than a right angle, angles of more than one dimension can be observed towards the corners of the prism. These false angles would of course lead to error, but by shutting off or blinding a portion of the prism, the false angles are eliminated, and the proper angle only can be observed. In the second and third prisms of the instrument these corners are blinded by a small plate of metal (see Fig. 3). An arrow on one of the circular discs (see Fig. 2) shows the corner of the prism, and the direction, in which an observer should look when using the second prism. In the right-angled prism all three corners are available for observation (see Fig. 5). Fig. 4 shows a position of the instrument when using the third prism. This third prism is, in my judgment, of little practical use in field range-finding. It is intended to measure the base formed by the first and second prisms, but it is very seldom indeed that a case occurs in which its employment is absolutely necessary. I think that the range-finding is more accurate without it, and as rapid; except in the instance of very long ranges, say two miles or so. However, it is not in the way, it renders the instrument complete, and its use has the very remarkable property of compensating for errors of observation of the length of base. The third prism with the second gives a triangle of which the base is to the side subtending the angle of 74° 55' 15" as 1 : 4.

A little practice is required to bring the image of any object to the right (or left) of an observer into the field of the prism. With the prism block turned at right angles to the case ring, the instrument is held as shown in Fig. 6, close to the eye, by which a large field is obtained, and only a slight turn of the head or hand is required to bring a fresh field into view, either laterally or vertically. The prism block is steadied by the thumb and forefinger, taking care to leave a space below the corner of the prism, so that objects seen in front by direct vision, either above or below the block, may be viewed simultaneously with objects reflected in the prism. The reflection of an object on one side of an observer is to be looked for in the corner of the prism furthest from the object; thus, the reflection of the man

at O on the observer's right is found at O', towards the left corner of the prism, Fig. 6.

The reflection of an object in any of the prisms can be aligned on any given point seen by direct vision in front, by the observer moving to the right, left, backwards, or forwards. In range-finding, if an observer sees the reflection of O (Fig. 6) fall to his right of a point D, he can bring O immediately under D by moving to his rear if D is far away; or to his left, or diagonally to his left front, if D is near. It is practically best, however, not to try to bring the reflection on any special object seen by direct vision, but to choose a distant object on which the reflection falls true, as in this case on the church tower.

The eye of the observer forms the apex of the angle to which the prism is cut, when objects on either side of an observer appear directly underneath (or above) those seen by direct vision; but to make a correct angle the reflected object should be kept upright and the reflected horizon as level as it is naturally, for if the instrument is held so that the ground reflected appears to slope when it is really level, or *vice versâ*, the required angle will not be observed. An observer also must be careful to fix his attention on the far-off direction point, and not on any intermediate object such as a pole, &c., which he has placed as a guide to lead his eye straight to the distant point. This is often neglected at first, and leads to error. This is explained later on.

There are several methods of finding the range of a distant object with the prisms:—

First Method.—One observer using nothing but the second and first prisms in the order named. This appears exceedingly simple, but it requires a vast amount of training and practice. With unskilled observers it is unreliable.

Suppose the range of an object O (Fig. 7) is required. The observer using the second prism at B, reflects O on some distant point D. The angle $OBD = 88^{\circ} 51' 15''$. Selecting any intermediate object, say E, on the line BD, to assist him in walking straight, he paces towards D, stopping to observe at intervals with the first prism, until he arrives at A, where he sees O reflected along the line AD, so that the angle $OAD = 90^{\circ}$. In moving from B to A he has counted every second pace by the simple rule of commencing with the left foot and counting a unit every time the right foot came to the ground. These units of base represent hundreds of yards of range. The greater the excess of BD over BO, the greater the chances of accuracy.

Second Method.—One observer using the first and second prisms, aided by a mark such as a pole, or a man, a sword stuck in the ground, or anything that can be left to mark a particular spot. A specially made pole is the best.

Taking the same figure (Fig. 7) with O as the point of which the range is required, the observer, using the first prism at A, reflects O on a distant point D, and plants a pole at this spot. He turns the prism block so as to have the second prism ready with the blind on the same side as the object, and retires on the line DAB. He stops to observe, facing D; perhaps seeing the reflection O on *his* right of

D. He has not gone far enough. Suppose he moves too far to the rear, he will see O on *his* left of D, and must advance; but he quickly finds the point B where O is reflected true on the line of the post at A and the distant point D. Then, as before, the base $BA = \frac{1}{50} OA$, and may either be paced as described under the first method; measured with a tape, on which is marked hundreds and tens of yards of range; or measured by using the third prism, as described under the third method.

In either of the above methods, if a good natural direction point D cannot be found, a pole, or a man with a rifle or stick, may be placed as a direction point, care being taken to place the pole, or whatever else is used, at a distance from A proportionate to the range. Thus, if O is probably about 1,000 yards away, the pole should not be less than 50 yards; if OA be 2,000 yards, the distance point should certainly not be less than 100 yards, from A. The further the distance point the greater the chance of the range found being accurate. It rarely happens that a good natural distant direction point cannot be found on one side or the other, in country where troops are likely to want to know a range.

Third Method.—If it is thought desirable to measure the base AB (Fig. 7) found by the second method, with the third prism, another pole or marker is required. Having found A and B by using the first and second prisms, the observer plants the second pole at B, hooks to it one end of a tape on which is marked hundreds and tens of yards of range at every 18 inches, and walking back on the line OB, he arrives at a point C, where the pole at A is reflected along the line BO. Then $CB = \frac{1}{4} AB = \frac{1}{200} AO$. Every hundred yards of AO is thus represented by 18 inches of BC.

This method is introduced to meet the difficulty of measuring a long base AB accurately if the ground is rough, or if obstacles intervene between A and B. Thus, supposing O to be 5 miles distant, BA would be = 170 yards, and it would probably be considerably quicker to use the third prism than to pace or measure the base, but for ordinary artillery or infantry ranges, the base AB is so short, that I think it is quicker and more satisfactory to pace or measure along the base.

Fourth Method.—This is also rapid and accurate, but needs some training. It requires two instruments and two observers, each using the second prism. It adds to the capabilities of the instruments one advantage over other systems of range-finding with which I am acquainted, viz., ease in ascertaining rapidly the range of a moving object. This, as I have said, was a point claimed for Colonel Weldon's earlier range-finders, and his latest instruments retain the advantage.

Turning to Fig. 7, suppose O to be again the object whose range is required, an observer X, using the second prism, reflects O on the second observer Y, moving either to his right or left for the purpose, but not to his front or rear. Y, also using the second prism, moves either forwards or backwards, but never to his right or left, until he gets the reflection of O true on X. Then each of the

angles OXY and $OYX = 88^{\circ} 51' 15''$ and $XY = \frac{1}{2\frac{1}{5}}$ of XO or YO . Every 4 yards of the base paced represents 100 yards of range. In practice whenever either observer sees that he has the reflection of O truly on the other observer's instrument, he raises his disengaged hand. When both observers give this signal at the same time the base is found. By this arrangement little difficulty is experienced by trained observers in getting the base, even if O be moving with considerable rapidity. Directly the signal is simultaneous the base is paced, a few seconds sufficing. Neither observer under any conditions requires to move more than $\frac{1}{2\frac{1}{5}}$ of the pace of the moving object.

Little accuracy of result will be obtained by pacing, as described in the above methods, unless an observer is trained in pacing yards. A man can be trained to do so in a very short time, but practice is necessary to keep up the attainment. A plan which has been found very successful is as follows:—200 or 300 yards are measured on some line which chances to be aligned on distinct objects, so that men may be able to march straight along it. At each hundred yards a peg is driven in to the head, so that it cannot be readily seen. For a few yards at each end of the line pegs are also driven in to a level with the ground at every yard. The man paces up and down these minor marks, until he gets an idea of a 36-inch pace, and he then paces from the starting point along the whole line. Commencing with the left foot, he counts the number of times his right foot comes to the ground, and halts when he has counted fifty. If he has paced yards correctly, and walked straight, his right foot should be on a peg, if not, the difference constitutes his error. He soon learns not only to pace yards but to march straight, and to count without effort the number of hundred yards in a range formed by the first and second methods. For the fourth method his counting should run 1.2.3.1; 1.2.3. 2; 1.2.3. 3; counting each pace, and his right foot would be on a peg when he has counted 25.

It has been objected that the base used in the first and second methods is too small for accurate results. Fig. 8 is a figure drawn to scale.

It is impossible for the eye to distinguish the exact point where the lines AO and BO cut one another about O . A base of 1 : 50 appears altogether too small to measure such an apex angle as AOB , and so it would be if the base were found by measurement of two interior angles. It is the attempt to measure the interior base angles of a small based triangle that proves the greatest source of error in most systems of range-finding. When the distance is too short between the eye and the other end of the base, the least lateral movement of either sensibly affects the result. This is easily demonstrated by the following diagram.

Suppose two lines $D'Y$ DY inclined to one another at a small angle. For a considerable distance they appear to run in one line, but the eye detects divergence at X and Y . With XY as a base erect a triangle XOY , and suppose the apex O to be an object of which the range is being taken. The observer at Y in measuring the angle

OYX may be observing either of the angles OYD or OYD', and similarly, if his eye has no further than Y to travel, may observe false angles when measuring OXY. The greater the distance of D and D' from Y, the more easy is the error detected. Lateral error, in fact, creeps in with greater or less ease, according as the base XY is shorter or longer.

Weldon avoids this source of error in a very simple manner by observing one interior and one exterior angle, so that for range-finding purposes his base is from the eye to the far off direction point, which is possibly 10 miles away. Thus in Fig. 9 he uses the angles OYD, OXD'. It is this which enables a simple instrument, devoid of telescopes or other complicated aids to the eye, to obtain such correct results.

Colonel Weldon has some Wollaston's prisms, giving the required angles of reflection, in which light is totally reflected within the prism. Silvering is here unnecessary, and instruments so made are absolutely free from the influence of climate.

The time at my disposal will not allow me to do more than state the general results of official trials of the range-finder. All reports that I have seen have been, with one exception, highly favourable. In nearly all cases it appears to have been tested against Watkin's range-finder, and generally by observers practised in the use of the latter, but to whom the Weldon was a novelty, and who in some instances used it for the first time at the trials. The fact that under these circumstances remarkable accuracy was generally obtained is perhaps the highest testimonial to the efficiency and simplicity of the system. The exception mentioned above was a report from Bombay, which, though on the whole favourable, stated that the Watkin range-finder proved in most instances the most accurate at very long distances; there were no serious discrepancies between them, and it was further remarked that had the observers had as much practice with the Weldon as with the Watkin, the results might have been different. Few of the reports take the time occupied in finding a range into account, yet the great rapidity with which distances can be measured with the Weldon is, combined with its general accuracy, one of its strongest recommendations as a field range-finder.

The chief points urged in favour of the Weldon system in the various reports are:—1st. That it is easy to learn and teach its use. 2nd. Not liable to get out of order. 3rd. Practically accurate. 4th. Compact. 5th. Portable. 6th. Light. 7th. Cannot get out of adjustment. 8th. Serviceable in the field. 9th. When mean of two observers is taken ranges found are as near as possible correct. The only objections I have seen in the reports are:—1. That it is difficult to obtain coincidences in a bad light, or in a very bright light. 2nd. That there is a glare from the metal case, and that the case should be of dull metal. 3. That there is a difficulty of obtaining coincidences, owing to the thickness of metal of prism block.

With regard to the latter, the metal of the prism block is now made very thin. It would be a decided advantage if it could be done away with altogether. The first objection is common to all

range-finders. The second is easily got over by shading the instrument with the disengaged hand.

The most exhaustive, and probably the most accurate, official trials in England were those made at Aldershot. I have not had access to the original papers, but I believe that the following figures are correct as to one series of observations:—

| Number of observations. | Ranges measured on O.S. map. Yards. | Weldon. — Error in yards. | Watkin. — Error in yards. | Error per cent. of range. | |
|-------------------------|-------------------------------------|---------------------------------|---------------------------------|---------------------------|---------|
| | | | | Weldon. | Watkin. |
| 100 | 183,015 | 3,390 | 7,342 | 1·8 | 4·0 |

and it is curious that a long series of official trials in India gave very similar results.

One remarkable observation occurs in the report of trials at Bangalore.

| | |
|---------------------------------------|---------------|
| Distance observed by Weldon R.F. | 14,350 yards. |
| „ accurately measured by theodolite | 14,400 „ |
| Error | 90 „ |

The distance is over 8 miles.

In some of the Indian trials the average time taken in obtaining measurements of ordinary ranges is given as $1\frac{1}{4}$ minutes. I have myself seen many correct ranges taken in less than 1 minute each, and the distance of moving objects very approximately given in from 35 seconds to 50 seconds, by well-trained observers.

Major A. FEATHERSTONHAUGH, R.E.: When I was in India I saw some observations taken with Colonel Weldon's instrument, and I also saw another instrument used, which was really a modification of the Weldon instrument by Mr. Bolton. It was very much on the same principle. The original base adopted by Colonel Weldon was one-twentieth. There was an official trial made of the Bolton instrument, which, as I said, is very much the same as Colonel Weldon's, before the Commander-in-Chief in Calcutta, and although no opinion was then expressed, the difficulty in the minds of those who had to judge of the subject was that the base was too long. It was only one-fortieth, but it seemed to be very long. It has now been reduced to one-fiftieth, but that is still very long, being 20 yards per 1,000 yards. 1,000 yards is not a very long range now-a-days for artillery purposes, but if you are on the top of a hill, such as you get in Afghanistan, it is very difficult indeed to get 20 yards straight on end in every direction. I should be glad, therefore, if Colonel Richardson could answer that question as to whether even 20 yards per 1,000 is not rather long. My second remark is upon the fourth method of observation, which Colonel Richardson says he finds useful in taking the distance of moving objects. You have two men, one at Y and one at X, taking the distance of the object at O, and that object is supposed to be moving at 5 or 6 miles an hour, or more. If it is a steamer it would be going 10 or 12 miles an hour. These two men have to take

two observations of this moving object, and to manage so that their observations are simultaneous. I should like to ask how is that possible, seeing that they have no communication with each other? How can they arrange to get their observations absolutely simultaneously? It is just as if two men were firing at a partridge, one holding the gun and the other pulling the trigger. I think, therefore, there must be something that is not quite clear about this finding the distance of moving objects by the observations of two men. The only other thing that I would refer to is the last paragraph of the lecture, in which Colonel Richardson mentions a series of observations taken at Aldershot, and out of 100 observations he gives the error per cent. of range with the Weldon instrument as being 1·8. That I suppose is the mean. Those who have had to deal with astronomical observations know that provided there is no radical error in the process you may get a mean of any accuracy you wish by multiplying your observations, because although one observation may be a large distance wrong in one direction, the next observation may show the same error in the other direction, and the result is you get a mean error of a very small amount, whereas the error of a single observation may be very large indeed. It seems to me that for military purposes your first observation should be as accurate as possible, and it is no good saying that twenty other observations taken immediately afterwards would give a small mean error.

Major WHITE: In rising to speak on this subject I may state that I do not come forward in any official capacity. I am, however, instructor in field range-finding to the mounted branches of the Royal Artillery, and at present in charge of the School of Range-finding at Aldershot, and I was Secretary to the Committee on Range-finders from 1879 to 1881, so that I have some experience in these matters. Now, I think, that too much attention is paid to the range-finder and too little to range-finding. It is as if the whole of a discussion on musketry were to be devoted to the particular rifle used, and not to the shooting. A great deal depends on the way in which an investigation of this kind is conducted, for while no doubt various instruments have various merits, one is often better than another for a particular purpose. Colonel Richardson has brought forward this range-finder as an infantry instrument, and therefore I cannot say so much about it. The infantry know their own requirements best. Of course an individual soldier does not take the range to each opponent he aims at; but no doubt in the field if you got a large body of infantry or cavalry *stationary*, and you wanted to fire at a long distance which you could not measure by the eye, then the aid of the range-finder might be important, and in that case an instrument which gave *approximate accuracy with rapidity* would undoubtedly have a great advantage over one which gave the greatest accuracy but with some loss of time. I have myself carried out a number of trials with the Weldon range-finder, and with instruments identical in principle,¹ and I have seen the reports of other trials. The result I find is that it will take the range with approximate accuracy and considerable rapidity. I do not know the exact comparison, but it will take it quicker than the Watkin range-finder, because a much shorter base is used. The time occupied in taking the range with the Watkin range-finder is that taken up in running over the base and back again by the range-taker in addition to the time needed for the two observations, which you may say is one minute for a long range, and half a minute for a short one; thus with the Watkin range-finder up to 1,000 yards we allow two minutes per range, and as we increase the ranges we increase the bases, and therefore the time, until when we get to 6,000 or 7,000 yards we allow as much as six minutes per range; but of course very long ranges would only be taken for artillery purposes, and under circumstances in which spending five minutes or even a quarter of an hour more or less would not very much matter. It would be the case of engaging an enemy which had fixed positions at great distances, and where it was of the greatest importance to get an accurate range within 100 yards or less. With regard to the Weldon range-finder, it undoubtedly finds the range quickly if it finds it at all, but it has the disadvantage that there are many places where it is altogether inapplicable. You are tied down to a certain base, and you may find that

¹ Mr. Erskine Scott's range-finder; the Steiner range-finder; the Edwards range-finding system.

it lands you in a pit, or a hedge, or the middle of a wood, or it runs you down the side of a hill, and you cannot see the auxiliary object that you have to line yourself on. What you want is to be able to put down a marker at any point and take the range from *that* point; it is no good finding the range from somewhere else when time is an object; that may be very useful, but you have to consider the time lost in making the correction. That is a disadvantage constantly met with when you are dealing with lumpy ground—I won't say hilly ground—because you may get very good ground for the Weldon instrument in a hilly country; you may get slopes giving you plenty of base; you may see your object in whatever direction you go, and you may get distinct auxiliary points. It is, however, a very great tie to be compelled not only to see your distant object from your own pickets at each end of your base, but also to find something to your right or left to work upon. There are many cases where you cannot find the range on account of the proportional base. You think you are going to get it, but a house comes in the way or a tree, or something just at the point where you ought to make your second coincidence, and then you have to begin *de novo*. I think on the whole, however, that these instruments may be made very useful, and we are very much indebted to Colonel Weldon for what he has done so far. There was no doubt a difficulty at first in getting the prisms properly cut, but the Service specification allows a liberal margin for their accuracy; it actually allows two different instruments to have a plus or minus error of $2\frac{1}{2}$ per cent., that is, a difference between them which would amount to 5 per cent. difference of range (5 yards per 100 yards), though the variation would rarely of course come up to that. That is the Weldon. The first Watkin instruments were given to the regiments for use, but the men were not shown how to use them. The result was they broke them very quickly. It was very much as if you had started a telegraph, and sent your instruments and wires down to various regiments, and said, "There, that is a nice telegraphic apparatus; let Tommy Atkins use it." The result would be, no doubt, that he would break it. It was the same with these range-finders, and I am not at all surprised that they could not take a range. But now-a-days we have established a school of range-finding. We take our non-commissioned officers of Horse and Field Artillery and put them through a very severe course of training. If, at the examination, their average work shows inaccuracy exceeding 4 per cent. in the range, they do not get a certificate. If it is better than that, they are marked "good," and if the error is less than 2 per cent., they get "very good;" and out of a class of about twenty, there are often two, sometimes three or more, who get "very good."¹ So much for the Watkin. It is a very good instrument, and there is not much fault to be found with it. Nevertheless, you can get approximate accuracy with greater rapidity sometimes if you use the Weldon, and for infantry purposes they want very rapid methods without much trouble in learning. With regard to the use of the instrument, however, there is one great difficulty. You *must* hold it in the plane of the objects, and this is not an easy thing to do when they are not in the *horizontal* plane. The result of our first trials at Aldershot was this:—They showed that if men were well trained they could use the Weldon instrument very well, but that they required even more intelligence and training to use the Weldon *properly* than to use the Watkin. That of course is easy to understand, although if you give the Weldon instrument to a man who has never seen it before, you can teach him in an hour or two how it is to be used. For instance, Officers have come to me, and I have soon taught them how to use the instrument, but they have not always seen that they would want months of practice with it in order to take ranges accurately. With the Watkin instrument they would not be able to take a range after, say, only half an hour's instruction, but with proper training the use of the Watkin instru-

| | | | | |
|---|-------|--|----|------------|
| 1 | 1885. | Class of 21 non-commissioned officers— | 6 | very good. |
| | | | 12 | good. |
| | | | 3 | failed. |
| | | „ 16 | „ | „ |
| | | | 3 | very good. |
| | | | 10 | good. |
| | | | 3 | failed. |
| | | „ 7 | „ | „ |
| | | | 6 | very good. |
| | | | 1 | good. |

ment becomes mechanical, and it tells its own tale. Colonel Richardson says, "It rarely happens that a good natural distant direction point cannot be found on one side or the other." At the camp at Hay last year I attended the artillery practice that was carried out with range-finders, and I know that in *many positions* we could not possibly have found a good distant point. It is really very hard to find. With reference to the fourth method of working, mentioned by Colonel Richardson, I quite agree with Major Featherstonhaugh that you must not employ two observers. In all range-finding you have to observe *a point*. Now, if you see a body of infantry you may say, "Take *that Officer* as your point." Oh, yes, but *that Officer* is a different one in the estimate of No. 1 and No. 2, and the chances are that your second observer takes the wrong man. And then even taking to a man, say, a cavalry soldier, you must have an idea whether you are taking to his head or to his horse's nose. In this way, too, observers make terrible errors. We never allow a second observer with the Watkin instrument on this account, although we should save time immensely by doing so. Generally speaking, you have to take such objects as rifle-pits, shelter-trenches, and so on, often some little lump of ground which is very difficult to see, and which you cannot possibly explain to another man. I think, therefore, that the fourth method does not answer. With regard to length of base, there we come on to ordinary scientific ground. Apply it in any way you like, the human eye, unassisted by a telescope, cannot appreciate a difference of angle of less than about one *minute*. If you take a triangle and solve it, you will find that if you make an error of one minute in each base angle, whether you measure the exterior or interior angles, you make an error of something like 3 per cent. in the range, when the base is about one-fiftieth the sides, unless the errors happen to be in the right direction for correcting each other. You get very much less error in range as you get longer bases. Colonel Richardson has quoted the Aldershot trials to show that the Weldon range-finder is superior to the Watkin in accuracy. Now there were some inconclusive trials in 1883 when some damaged Watkin instruments were compared with some new Weldon range-finders, but even then the results reported do not appear to agree with Colonel Richardson's figures. I have in my hand my own report of the second trials at Aldershot in 1884 under my supervision. These are the results :—

| | | Error per cent. of range. | |
|----------------|-------|---------------------------|---------|
| | | Weldon. | Watkin. |
| 1,000 to 2,000 | ..... | 5·8 | 0·75 |
| 2,000 „ 3,500 | ..... | 4·97 | 1·00 |

The Weldon was rather better at the longer ranges compared to itself, but the error was nearly five times as much as with the Watkin. The errors, however, were not very great. The Weldon only made an error of 50 in 1,000 yards.¹

¹ In the trial referred to there were three observers, and about 400 observations were taken with two Weldon range-finders ; they were used—

1. Without equipment ; men as markers and the bases paced.
2. With pickets, but all bases paced.
3. With pickets and the bases measured.

One instrument read from 1 to 2 per cent. better than the other. The *best* gave the following figures :—

Mean Errors per Cent. of Range.

| 1st. Without equipment. | | 2nd. Pickets only. | | 3rd. Pickets and tape. | |
|----------------------------|------------|------------------------|------------|---------------------------|------------|
| 1st and 2nd prisms. | 3rd prism. | 1st and 2nd prisms. | 3rd prism. | 1st and 2nd prisms. | 3rd prism. |
| 7·61 | 10·11 | 6·15 | 7·80 | 5·57 | 6·76 |

Major-General DRAYSON: I wish, Sir, to take up the history of this instrument a little earlier than I think Colonel Richardson has mentioned. In the year 1864 I had a great deal to do with range-finding, and the introduction of range-finding into the artillery. I found when I had non-commissioned officers to deal with, that the difficulty of their reading the vernier was so great that I used the Hadley sextant clamped at particular angles, so that they could not by any means alter the vernier; the angles I selected were $84^{\circ}17'$, which gives a range ten times the base, $87^{\circ}8'$ which gives 20 times, and $88^{\circ}33'$ the same as Colonel Weldon has used. After a time I thought it would be much more simple to get an instrument made by Messrs. Troughton and Sims, on exactly the same principle as a Weldon, with the exception that I used glasses instead of a prism. These glasses gave an angle of $87^{\circ}8'$, and a range twenty times the base. I was very much attracted by this instrument at first, and several old Officers of artillery, who had forgotten how to use the vernier, were delighted with it. As long as I was on Woolwich Common I could get my range admirably. There was a fine open space, and when we compared the distances with the Ordnance map, we found the results very accurate. But as soon as I got into the country, the difficulty mentioned by the last speaker occurred. I wanted a base one-thirtieth or one-twentieth of my range, and when I walked back to get it I got into a hedge, or a sand-pit, or something of that kind, and I could not get my range. I had to get the other man to move further off, and then he would say he could not get any further. The result was we gave up this system, in consequence of the base always necessarily being a certain proportion of that range; this, I think, is a defect in any range-finder. If you get a fine open level space where you can see distant objects, and see the second man, there is nothing better than the system I adopted. I am somewhat surprised to hear from Colonel Richardson that he seemed to think the first experiments made by Colonel Weldon were original. They are identically the same as mine made nearly twenty years before. Now I gave a lecture at the Indian United Service Institution, at Simla, in 1876, at which there were several distinguished Officers present, and amongst them Sir Frederick Roberts and Sir Peter Lumsden. Sir Peter Lumsden was so taken with the instrument that he suggested it should be supplied to the different garrison instructors in India. I told him I thought it would be no good, and that I did not recommend it. Some years after that Colonel Weldon produced his instrument, which is precisely similar to this, and I think it at least singular that he should claim it as his invention. I can answer one point raised by the first speaker, namely, that with this and a second instrument we can

The same ranges were taken with two Watkin range-finders, the average mean error per cent. of range being 1.08. That this is not an exceptional figure is proved by the results of the range-finding at Hay in 1885 by the range-takers of the batteries which practised there in succession, and which are marked in the columns as 1, 2, 3, &c.

| | 1. | 2. | 3. | 4. | 5. | 6. | Remarks. |
|--|----------------|------------------|------------------|----------------|----------------|------------------|--|
| Number of observations | 6 | 8 | 7 | 8 | 7 | 16 | |
| Greatest error in each series, per cent. of range .. | 3.9 | 7.0 | 2.5 | 2.4 | 3.3 | 3.3 | The range-taker of the seventh battery in camp was absent. |
| Longest and shortest range taken | { 1,906 800 | { 2,896 1,400 | { 4,050 1,605 | { 2,896 800 | { 2,896 610 | { 2,896 1,400 | |
| Average error per cent. of range .. | 1.5 | 2.9 | 1.0 | 0.96 | 1.4 | 1.7 | |

take ranges of moving objects as simply and exactly as we can objects not moving. It is not the case of one man holding the gun and the other pulling the trigger. One man stands with this instrument in his hand, and it is his business to keep the second man and the distant object in coincidence, and he does that by moving backwards and forwards; he keeps on doing it, and he has tremendous power of doing it, because if the base is only one-twentieth of the range, he need only move at one-twentieth of the speed of the distant object, so that he can actually keep a railway train in coincidence. The second man does the same thing, it is his business to move a little further off, or to come closer in; there is no difficulty whatever. I have taken steamers at Portsmouth and on the Thames, and at intervals of half-a-minute I have given what the range has been. One other point, I think, is very essential: it has been mentioned by Major White, namely, that you not only have to train your range-finders with the greatest care, but in addition to that you have to keep them in practice. Not long ago, when I was at Halifax, in Nova Scotia, we got some men who had first class certificates for having found ranges with the Watkin range-finder. The first thing that those non-commissioned officers said to me when I asked them to take a range was: "We have not used this instrument for two or three months; we are quite out of practice;" and they were so much out of practice that they could not get the range at all. I think the essential defect of any range-finder is where you have no mobility of angle and base, for if you are fixed to a particular base you will be running foul of objects just at the time you want to get your range, and so you may lose your opportunity and the time will be passed for the range being of any service at all.

Captain C. B. MAYNE, R.E.: I would like to say a few words, Sir, on behalf of the infantry, although I am myself an engineer. In the first place, the conditions of using range-finders for infantry and artillery are very different. The artillery often have to fight at very long distances, and in all cases want their range exactly, but under conditions which, in a large amount of cases, are different from those for infantry. It is a curious fact in infantry fire that when the men all fire with the same elevation, then from 500 yards and upwards, the mass of the bullets, or rather the best or inner 50 per cent. of them, fall fairly evenly over 100 yards; this fact should be borne in mind in constructing infantry range-finders, and it is upon this fact also that all the rules of firing on the Continent are based, especially with regard to judging distances by the eye. Abroad they say the average error of judging distances is one-eighth the estimated distance; but this may be under or over the range, so that the total error to be allowed for is one-fourth the estimated range. Up to 400 yards the total error of judging the range is under 100 yards (the length of the spread of the bullets), and consequently there is no necessity to use more than one elevation up to 400 yards, especially as the bullet remains under the height of a man up to that range if aim is taken as his feet. Up to 800 yards the total error to be allowed for of one-fourth is 200 yards, and therefore we must divide the men firing, and make one-half of them use a sight for 50 yards over, and the other half a sight for 50 yards under the estimated distance, so that their bullets will spread over 200 yards, and then cover the ground on which the objective stands, in that way. The same method can be used up to 1,200 yards, but there we must use three sights, one for the estimated range, one for 100 yards over it, and one for 100 yards under it, so as to cover 300 yards of ground with bullets. But that means a great expenditure of ammunition, and it seems that we can only really get the greatest efficacy for infantry firing that can be obtained by the use of a range-finder, which will give the range to within 50 yards up to 1,500 yards, the maximum range for infantry fire in the field.¹ Supposing we are in a defensive

¹ Perhaps this is a very severe condition, and a more just one would be to give the range within 100 yards up to 1,500 yards, and to within 50 yards up to 1,000 yards, which would require the use of one sight only up to 1,000 yards only, and two sights only up to 1,500 yards. This would suit the organization of our smaller units, as a use of three sights would find considerable difficulty in our ranks, unless we devote three whole companies for the purpose, because it is laid down in Germany that when three sights are used, a whole company (250 men) should be employed, and the German company is organized in 3 *züge*. When two sights are used they say

position, and the enemy has not arrived. Of course under such circumstances any range-finder can be used, and distances can even be measured if necessary. For the former purpose, I think one of the simplest range-finders is the plane-table. One advantage of this instrument is that with the same base one can find the range of any number of objects in different directions, whereas with all other range-finders, the Weldon, the Watkin, and so on, for each object (if they are not all in one line) one has to take a different direction of base, which is a very serious objection, especially when one is on a ridge, as would be the case for troops in a defensive position, because if the further end of your base lies over the ridge you cannot see the distant object to find its range. With the plane-table you can take a great number of ranges in any direction from the same base, and if it is done on a sufficiently large scale, and with a sufficiently large base, very accurate results can be got. But in action, when the "music" has begun, and we are acting on the offensive, I should like to see anybody trying to use any of these range-finders, having to move, as they would have to do, up and down the firing-line, in order to take a range in the midst of all the smoke which is hanging about both in front of the defensive line, observing the objective whose range is required, and in front of the attacking troops, making the light misty and dim. For such purposes, I think, that any range-finder for the infantry should not have a base longer than the length of a rifle, or of an Officer's sword. All the range-finders at present before the public are admirably adapted for the artillery, who are stationary and have ample time and everything else in their favour for using them, but for infantry who are moving, I think that any range-finder that requires a base longer than a rifle or a sword, as the case may be, or has an error greater than 50 yards up to say 1,000 yards as a minimum, is not of any value to infantry; I do not see how they are going to use it under fire. There are some range-finders that I have tried that allow of a small choice of direction in the base; one is a very small and handy range-finder called the Labbez, which allows about 5 degrees in choosing the direction of the base. I have also tried the "Bate" instrument, made by Messrs. Elliott Brothers, which is a new one, and can be attached to one's field-glasses, and also one latterly introduced by Mr. Steward, both of which allow of about 30 degrees choice in the direction of the base, and they all three employ the principle which Colonel Richardson pointed out, of measuring one exterior and one interior angle instead of two interior angles as is done by the Watkin. They all have given very fair results as compared with the Watkin. This choice of direction in the base line is one thing the Weldon does not give, nor does the Watkin.

Admiral BOYS: Might I ask the cost of one of these Weldon instruments?

The CHAIRMAN: I don't think it is very much.

Colonel RICHARDSON: 1*l.* per prism; 3*l.* in all. In reply, I really seem to have very little to reply to, for most of the remarks have been made on other range-finders. Major Featherstonhaugh referred to the "Bolton." I can tell you that the Bolton range-finder was brought out after a lecture which I gave at Simla on the original Weldon instrument, and I heard from Mr. Bolton that it was nothing but the Weldon instrument over again.

Major FEATHERSTONHAUGH: I explained that; I said that they were practically the same thing.

Colonel RICHARDSON: Major Featherstonhaugh also said that the base was too long, and in particular that for mountain ranges it is too long. I have not had the opportunity of trying the new instrument on mountains, but it has a very much shorter base than the old one, which I tried a great deal in the Himalayas on the worst ground possible. I saw artillery practice carried on there with the aid of these range-finders with most excellent results. I am talking of the old Weldon range-finder. The mountain batteries adopted it, because it was the only range-finder that would find a range on such hills. With regard to moving objects the

that a whole *zug* or eighty men (that is to say about an English company) should fire to obtain a good result. Two sights could easily be used by us but not three sights, and any instrument which will enable us to make use of two sights only up to the extreme range of infantry fire should be eagerly sought after. Mr. Mallock's instrument seems to offer such an one.—C. B. M.

difficulty has been explained away by two other speakers, who have answered that question entirely, and in fact there is no difficulty whatever in finding the approximate distance of a moving object.

Major FEATHERSTONHAUGH: How do you know whether you are right?

Colonel RICHARDSON: We used to send a man out galloping. I had a signaller by me, and the mounted man was ordered to stop the instant a large flag or ball was raised. He was set galloping, and on the range-finders both saying "Right," which they did when each had the reflection of the man true on the other, the man was halted by the signal; he might perhaps move five or six yards after the signal was given, if he was trotting or walking, but when he was galloping, it was a little difficult to stop him, though he halted as soon as possible. The range was sometimes chained up to him, or it was sometimes taken using him as a standing object, or sometimes he planted a pole, so as to mark the spot still more accurately. The errors were found to depend more on the training of the men who had to find the range than on anything else. The ranges were found to be exceedingly good with well-trained men, and we usually found that a man was well trained after he had been at work about a fortnight. Major White, who is an instructor in range-finding, says that months of practice are required, but that is not my experience. I also have been an instructor, have had a good deal of practice with this particular range-finder, and I have not found it so at all with a good system of training. Major Featherstonhaugh also mentioned that astronomical observations can be very accurately taken; no doubt they can, but then think of the time they take! If you go into minutiae you can take ranges with extreme accuracy; you take your theodolite, and you measure bases and so on, but what I look for is speed.

Major FEATHERSTONHAUGH: I said that the mean error was no guide to what the extreme error might be.

Colonel RICHARDSON: I do not know that; that is a mathematical question I will not go into. I think the mean of many observations gives a very fair idea. It appears that Major White's idea is that a range must be found from an exact point. To me a yard or two one side or other of a fixed point makes very little difference, because I can add two or three yards to the range found without difficulty. Although I have taken many thousands, perhaps hundreds of thousands, of ranges, I have never found these difficulties about the base, though no doubt difficulties may be found if sought for. There is certainly no difficulty in getting the objects practically in the true plane. The eye alone tells you that. Look at the number of ranges which have been found, and are constantly found, with this instrument with a close approach to accuracy. I do not think there can be any great inaccuracy in it from this cause. There is occasionally, but very rarely, a difficulty in finding a distant point, and then the simplest way is to send out a man, which is done extremely quickly, and you get very fairly accurate range results. I have not found that two observers always fall into error. My experience is you can train men to work perfectly well together. Major White claimed to know the working of the Weldon instrument very well, but talked of the instrument measuring the angles at the base with a base of only 1 in 50. I tried to explain that the base for observing purposes in the Weldon is the far-off point, and not the base of 1 in 50. I particularly tried to point that out, and I am sorry that I did not make myself well understood.

The CHAIRMAN: We have another paper before us, and as the time is passing rapidly, I will only make one or two observations on Colonel Richardson's paper. It so happens that when I was in Calcutta I had the opportunity of trying both range-finders, the Watkin and the Weldon. I greatly admired the Watkin range-finder, and thought it a marvellously ingenious instrument, but much too delicate for rough usage. I certainly did think that the Watkin range-finder in the hands of the British soldier would be likely to be soon damaged irretrievably; but Major White says he has great experience of it, and found it answer very well. As regards the Weldon range-finder, it so happened that the chief assistant of my mathematical instrument office in Calcutta, Mr. Bolton, constructed what he called the Bolton range-finder, which was the same in principle as the Weldon and made with similar glass prisms, but with angles which, I think, were a little different.

He also constructed an ingenious stand for holding the instrument, and claimed that with the assistance of this stand he could get very much more accurate results than could be got by holding the instrument by hand. In certain instances his distances were checked by triangles measured with 8 and 10-inch theodolites, with great accuracy by practised surveyors, and they came out remarkably well. But I pointed out to him at the time that he could not expect to always have a great plain, as the *maidan* of Calcutta, to carry on observations of this kind; if he went up any of the adjoining streets, and wanted to know the distance of an object 400 or 500 yards off, he could not measure it; he could not have a sufficient base for the measurement, the breadth of the streets being inadequate. It struck me, therefore, there was an objection to the Weldon range-finder, in that it necessitated a compulsory length of base, one-fortieth or one-fiftieth of the distance of the object measured. I think we must all be very much obliged to Colonel Richardson for bringing the matter forward, for it is desirable that our Officers should know as much as possible of all the range-finding instruments which have been invented. I feel sure then that you will all join with me in giving a cordial vote of thanks to Colonel Richardson for his interesting paper. I have now to introduce Mr. A. Mallock, who has another instrument to describe to you, one of a very different kind, for it enables ranges to be found by measurement from short bases instead of long ones.

NOTE ON A SHORT BASE RANGE-FINDER.

By A. MALLOCK, Esq.

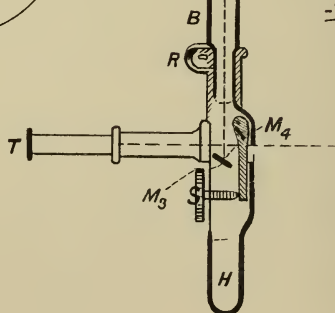
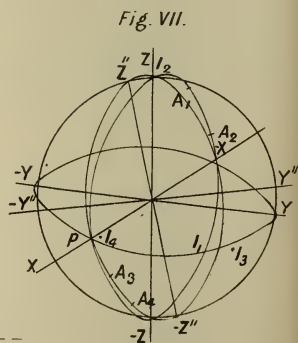
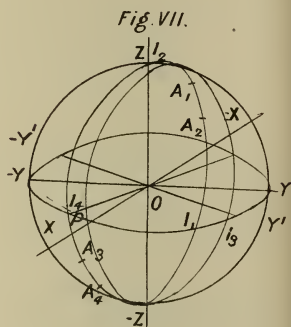
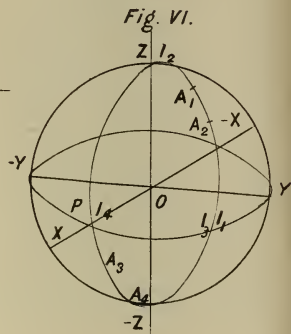
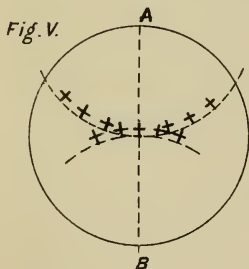
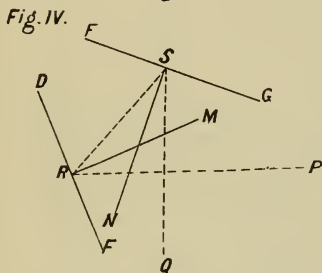
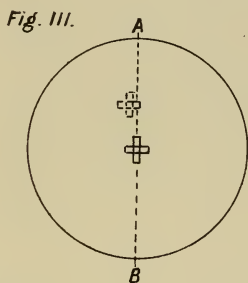
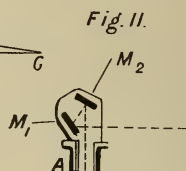
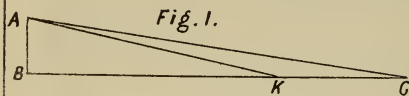
By the kindness of the Council of the Royal United Service Institution I am allowed to bring to your notice a range-finder having a base not more than 5 feet long, which is intended to give ranges up to 2,500 or 3,000 yards, with an error of, perhaps, a little more than 100 yards at the latter distance.

For the purpose of more easily comparing the actual performance of the instrument with its theoretical capabilities, I will, before describing its construction, consider one or two questions connected with distance measuring in general. Although these questions are doubtless familiar to all present, they will serve to bring into view the limits of accuracy attainable with short base instruments. The first principles involved, which are common to all distance measurements, will thus be separated from the mechanical and optical details of the particular instrument before you.

Measurements of distance depend in general on the knowledge of the angles of a triangle and the length of one of its sides, but when, as in range-finding, the angle opposite the base is very acute and the triangle is either nearly isosceles or right angled, the values of the acute angle and short side are all that are required for a very approximate measure of the length of the remaining side.

Dealing only with such acute angled triangles, I will inquire what error is produced in the result by a given error in the measurement of the acute angle. In the triangle ABC, of which C is the acute angle, let p be the ratio of AC to AB, and $KAC = \delta C$ the error in the measurement of C, then KC, the error in the measurement of AC due to the error δC , is $\frac{AC}{AB} \delta C \times \frac{AC}{AB}$ or $p^2 \delta C$, taking the length of AB as unity;

TO ILLUSTRATE MR. A. MALLOCK'S PAPER ON
A SHORT BASE RANGE FINDER.



and if a be the length of the base in yards, the error in yards is $ap^2\delta C$. The percentage error is, of course, $p\delta C$.

I will now apply this expression to determine the greatest value which may be given to p when a given accuracy is required in the result; or in other words, when a certain range has to be determined to a given degree of accuracy, how short a base may be employed for the purpose.

The quantity δC , the probable error in the observed angle, depends partly on the observer, and still more on the nature of the object observed, but assuming that the observer is good and the object well-defined I shall, I think, be rather over-estimating the quality of observations made with the naked eye in putting the probable error as one minute of arc. In certain cases, as with a sextant when the images of very well-defined objects, both distant (the sun and a clear horizon for instance), are used, rather better results may be got, but in general a minute of arc may, as far as my experience goes, be taken as the limit of accuracy attainable without the use of telescopes.

Let e be the permissible error per cent. in a given required range,

$$\text{then } e = p\delta C,$$

$$\text{and } p = \frac{e}{\delta C};$$

$$\text{or since } \delta C = 1' \text{ and } 1' = \frac{1}{3500} \text{ nearly,}$$

$$p = 3500 \times e.$$

Suppose e equal to 1 per cent., then $p = 35$, and if the range which is required is 1,000 yards, the length of the base necessary to measure this distance correctly to 1 per cent. is $1,000 \div 35$ or 30 yards nearly.

As the probable lineal error in the range increases as the square of the ratio of the range to the base, a 30-yard base would give a probable error of 40 yards at 2,000, and 90 yards at 3,000 yards range.

It seems plain then that, without the use of telescopes, there is no chance of attaining useful accuracy with bases short enough to form part of a portable instrument.

If, however, a telescopic power of 10 is used and we are content with an accuracy of 2 per cent. at 1,000 yards, the base required is reduced to a length of $1\frac{1}{2}$ yards.

I think it may be said then that, however perfect the arrangement of an instrument using this magnifying power and length of base, each single observation cannot be expected to give results closer than about 20 yards at 1,000, 80 at 2,000, and 180 at 3,000 yard ranges.

This magnifying power and length of base are nearly those which I have employed, believing that 10 is about the power which can be most effectively used in a telescope of the size required, and which is to be held in the hand without fixed support; and that 5 feet is about as long a base as can be handled easily under the same circumstances.

Having thus roughly examined what might be expected of a perfect range-finder of the dimensions I have named, I will describe the principle and details of my own.

Fig. 2 is a section of the instrument.

The base AB is made of a piece of hollow bamboo, and at A are a pair of mirrors M inclined at an angle of 45° to one another. The lower end of the base B is held in a stock H in which there are another pair of mirrors similar to those at A, except that the angle between them is not fixed at 45° , but can be slightly altered by the micrometer screw S. T is a telescope which looks partly into the mirror at M_4 , and partly on one side of it in the same way as does the telescope of a sextant.

Suppose now that the telescope is directed to a distant object; that object is seen in the ordinary way by means of the rays which pass beside the mirror M_4 ; but rays from the object also fall on the mirrors at A, and being reflected from the various mirrors in the order, M_1 , M_2 , M_3 , M_4 (as shown by the red lines) at last enter the telescope and form an image of the object in the same field as that occupied by the direct image (Fig. 3). The micrometer screw S is turned until by altering the angle between the mirrors M_3 , M_4 , the two images of the object are made to coincide, and the distance of the object is then read off on a divided scale, in front of the milled head of the micrometer screw.

It may be asked why there should be two mirrors at each end of the base instead of one, and as this point is very important, the possibility of using a short base depending on it, I will examine the course of the reflected rays in greater detail.

In Fig. 4 let DE, FG, be two mirrors; let a ray PR fall on DE, and being reflected from DE and FG follow the course PRSQ, let RM be the normal to DE and SN be the normal to FG.

Let α = angle between DE and FG.

ι = PRM.

θ = PIQ the angle which the ray incident on DE makes with that reflected from FG.

This angle $PIQ = RIS = 180^\circ - (IRS + ISR)$,

and $IRS = 2\iota$.

and $ISR = 2(\alpha - \iota)$.

$\therefore \theta = 180 - (2\iota + 2\alpha - 2\iota)$,

or $\theta = 180^\circ - 2\alpha$.

That is to say the angle between the rays approaching and leaving the mirrors depends only on the angle between the mirrors, and not on the angle at which it falls on them.

The ray then, which falls on the mirrors at the far end of the base is always turned through a right angle, because these are placed at 45° . The lower pair of mirrors turn it through an angle which can be varied by the screw S, but which is always, as before, twice the angle between them. The relative position therefore of the two images, of an object in the field of the telescope, one formed by reflection and the other directly, depends only on the angle which the members of each pair of mirrors make with one another and the distance apart of the pairs, not on the angle at which the pairs are presented to one another. In fact, as long as the rays from one pair can enter the other, and the

angles between the mirrors composing each pair kept constant, the position of the direct and reflected images remains unchanged.

This property makes rigidity in the base unnecessary; whereas, if the reflection was effected by single mirrors, rigidity, combined with constancy of shape, would be an indispensable condition.

What has just been said refers only to movements in the plane containing the perpendiculars to the mirror. The effect of turning either of the pairs about the axis of the base or an axis parallel to that of the telescope I will mention presently.

When it is considered how very minute are the angles which have to be measured in finding long ranges with a short base, it will be seen how important it is that results should not be dependent on any supposed rigidity or constancy of shape in the base itself. For instance, a base of 5 feet at 2,000 yards subtends an angle of 1 in 1,200, and to measure this angle correctly to within 4 per cent., which was before mentioned as the accuracy possibly obtainable with such a base, the error in the angle must not be greater than $\frac{1}{2\frac{1}{3}}$ of 1 in 1,200 or $\frac{1}{30000}$ which is about 7" of arc, but the mere accidental motions caused by the hands when holding the base make the latter bend by many times this amount. If then, instead of using a double reflection at each end of the base, a single mirror had been substituted, it would have been found impossible to make any trustworthy observations at all, for the reflected image in this case would be continually shifting through an angle twice that of the deflection of the base.

To illustrate this I have placed two pairs of mirrors on an upright stem, in the same relative position which they occupy in the range-finder, and as it is impossible to show simultaneously to an audience the images of an object reflected by the mirrors, in the field of a telescope, I will reverse the action of the instrument. In place of the eye I put an electric lamp and substitute a collimator for the telescope. The lamp now sends a pencil of parallel rays in part direct to the screen at A, and in part, after being reflected from the mirrors, to the screen at B.

The distance AB is now equal to the base, that is to say, to the distance between the pairs of mirrors. The two beams of light therefore are parallel, and proceed as if directed to an object infinitely distant. The angles therefore between the mirrors composing each pair are equal.

When I alter the angle between the mirrors of one pair, the spot of light at B moves towards A, and the beams instead of intersecting at infinity, intersect at the distance indicated on the scale I have placed on the screen opposite the spot of light. I will now cause the stem, which has been purposely made slender, to vibrate in the plane passing through it and the beam. You see that the spot of light does not alter its position on the scale. I now substitute a single mirror for each of the pair of mirrors, and adjust these single mirrors to reflect the light to B as before, but when the stem is caused to vibrate, the reflected beam is by no means stationary, although the motion of the stem is so small that it can hardly be seen, even by those who are quite close.

In any instrument which is likely to meet with rough usage, it is of course very important that such adjustments as may be necessary should either not require great nicety or not have to be often applied, and that when correction is necessary, it should be easily effected.

There are three adjustments in the range-finder before you, namely :—

- (1) The perpendicular to the mirrors forming each pair should lie in a plane passing through the axis of the base.
- (2) The axis of collimation of the telescope should also lie in this plane.

These two conditions need only be fulfilled approximately.

- (3) When the angle between each pair of mirrors is identical, the index of the micrometer screw must point to the sign of ∞ on the divided head.

This means that when the angles between the pairs of mirrors are equal, the two images of an infinitely distant object seen in the field of the telescope coincide, and therefore the distance indicated must be infinity. This adjustment may be made in several ways, either directly, by making the two images of a star to coincide and then setting the index to ∞ , or indirectly by observing an object at some known distance and then setting the index to that distance; but the best way, which is independent of known distances and which can be applied in almost any situation, is given by the following rule :—

Remove the bamboo base and place the upper mirrors in the stock, take an observation of any well-defined object, and set the index to ∞ . Then replace the base and again observe the same object. From the distance then indicated subtract one-tenth part and set the index to the remainder. The adjustment is then complete.

The *rationale* of this rule is, that since when the base is used, the pairs of mirrors are 5 feet or 60 inches apart, and when the mirrors are placed in the stock this distance is only 6 inches, the angles measured by the instrument in the latter condition are one-tenth those measured in the former. Setting the index to ∞ after the first observation is equivalent to ignoring the six inches between the mirrors altogether, and, therefore, when the sixty-inch base is again introduced, the angle measured is nine-tenths and the distance recorded is ten-ninths of what it should be. Thus subtracting one-tenth of this ten-ninths the remainder is the actual distance.

In the use of the instrument I find by experience that it leads to more accurate results, if instead of attempting to make the reflected and direct image actually coincide, the mirrors are so adjusted that the reflected image falls a little on one side of the direct one, the eye then has to judge when the two images are similarly placed with regard to a line at right angles to the base, or if the base be held vertically, when they are on the same level. To allow of the mirrors being adjusted for this purpose, the bamboo base and upper pair of

mirrors can be rotated round the axis of the former by the tangent screw R, Fig. 2.

The best distance apart at which to place the images can only be found by practice, and varies much for different classes of objects, the least definite objects as a rule requiring the largest distances.

As the adjustment just referred to is effected by rotating one pair of mirrors with reference to the others, I may here mention what the actual path of the image in the field of the telescope is when the mirrors are thus relatively rotated about the axis of the base and also when the rotation is about the axis of the telescope (a rotation of this kind is produced by a sideways bending of the base), these being the two rotations not considered when I referred to the use of double reflection. The geometry of the question is given in a note at the end of the paper, but the result is as follows. A small rotation about the base causes the reflected image to describe a circle about a point situated in the plane containing the axis of the base and the axis of the telescope, the motion of the image is in the plane of the field and the distance of the centre of motion from the image is equal to the distance of the image from the eye, and on that side of the axis of the telescope away from the base. Rotation of the mirrors about the axis of the telescope causes the image to move in a circle of equal radius, in the same plane, but the centre of motion in this case is on the base side of the axis of the telescope in Fig. 5. The angles through which the image is rotated being in both cases equal to the rotation of the mirrors.

When adjustment 1 is approximately correct, either of these rotations cause the image to move at right angles to the direction of the base, and, therefore, do not affect the motion given to the image by the micrometer screw which is parallel to that direction.

Any possible rotation of the mirrors can be compounded of rotations about three axes at right angles to one another, and it has been shown that about one axis, viz., that at right angles to the base and telescope rotation produces no effect, and that about the other two, the effect has no component parallel to the base.

On the whole, therefore, it appears that no moderate bending or twisting in the base can in any way affect the readings of the micrometer.

Of course the value of a range-finder must be estimated by the results it gives, and not by any theoretical immunity from error, so what I have just said is merely to point out the ways in which errors will not occur.

To show the kind of accuracy which is attained, I subjoin a table of a set of observations made by me on 4th of March of this year.

Observations made on March 4th, 1886.

PLACE OF OBSERVATION : Hill S.E. of Stafford Bridge, near Exeter.

WEATHER : Hazy ; Sunshine with intervals of Cloud.

Observations begun at 12.10 P.M. Instrument adjusted at 12.15 P.M.

| Description of object. | Observed range. | True distance. | Greatest deviation from mean. | Theoretical probable error for single observation. | Error of distance. | Time at which each set of observation was completed. |
|------------------------------------|-----------------|----------------|-------------------------------|--|--------------------|--|
| Parsonage House at Brampford Speke | 2250 | 2300 | 94 | 92 | 6 | H. M. 12 20 |
| | 2300 | | | | | |
| | 2370 | | | | | |
| | 2250 | | | | | |
| | 2380 | | | | | |
| | 2300 | | | | | |
| | 2300 | | | | | |
| | 2400 | | | | | |
| | 2250 | | | | | |
| | 2260 | | | | | |
| | 2306 | | | | | |
| Pynes House | 935 | 925 | 15 | 14 | 10 | H. M. 12 22 |
| | 930 | | | | | |
| | 920 | | | | | |
| | 930 | | | | | |
| | 950 | | | | | |
| | 940 | | | | | |
| | 930 | | | | | |
| | 935 | | | | | |
| | 930 | | | | | |
| | 950 | | | | | |
| | 935 | | | | | |
| Cowley Place | 1780 | 1760 | 45 | 48 | 4 | H. M. 12 24 |
| | 1810 | | | | | |
| | 1720 | | | | | |
| | 1780 | | | | | |
| | 1790 | | | | | |
| | 1800 | | | | | |
| | 1730 | | | | | |
| | 1720 | | | | | |
| | 1730 | | | | | |
| | 1780 | | | | | |
| | 1764 | | | | | |

| Description of object. | Observed range. | True distance. | Greatest deviation from mean. | Theoretical probable error for single observation. | Error of distance. | Time at which each set of observations was completed. |
|------------------------|-----------------|----------------|-------------------------------|--|--------------------|---|
| St. Paper Mills.. | 1680 | | 65 | 48 | | |
| | 1700 | | | | | |
| | 1780 | | | | | |
| | 1730 | | | | | |
| | 1800 | | | | | |
| | 1740 | | | | | |
| | 1680 | | | | | |
| | 1730 | | | | | |
| | 1730 | | | | | |
| | 1780 | | | | | |
| | 1735 | 1780 | | | 45 | H. M. 12 26 |
| St. Church..... | 2880 | | 227 | 140 | | |
| | 2750 | | | | | |
| | 2600 | | | | | |
| | 2950 | | | | | |
| | 2850 | | | | | |
| | 3000 | | | | | |
| | 2750 | | | | | |
| | 2850 | | | | | |
| | 2750 | | | | | |
| | 2850 | | | | | |
| | 2827 | 2850 | | | 23 | H. M. 12 29 |

Column I gives the nature of the object. Column II the range as found. Column III the true distance taken from the Ordnance map. Column IV the greatest deviation from the mean. Column V the theoretical probable error at the range with 5 feet base. Column VI the error; and Column VII the time at which each set of observations was finished.

It will be seen that the ranges obtained are not in all cases as near the true ranges as the consideration of what was theoretically possible led me to expect as the limit, but they approach it.

In using the range-finder I find it most convenient to hold the base vertical or nearly so, as then the weight of the instrument has no tendency to twist the hands, but in addition to this there are other advantages in the position. In the first place the observer may be almost in complete shelter; and, secondly, since most of the leading lines in a landscape are horizontal or nearly so, such as hedge-rows, outlines of hills, &c., these form as good objects for a vertical base to measure to as vertical lines do for a horizontal base, isolated objects being equally available for both.

The chief difficulties I have met with while constructing the range-finder have been getting the mirrors flat enough and getting sufficient light for the reflected image. In fact the want of light in the reflected image is its worst defect, for though in moderately good daylight this is not felt, yet in misty or dark weather it adds much to the difficulty of making observations.

If it were admissible to use a support, larger mirrors and a higher telescopic power might be used, in this case too the base might be doubled in length or more, and no inconvenience as to transport would be occasioned by this, as the base could be carried in short lengths and put together like a fishing-rod, and with such an instrument a high degree of accuracy could be obtained even at long ranges.

Even as it stands, however, though doubtless capable of much improvement in many of its details, I think the table shows that this range-finder is capable of giving results with a useful amount of accuracy and with considerable rapidity.

Note.

I have found the following method a simple one for tracing the position of the successive images of an object reflected by several mirrors. For the purposes in view the planes of the mirrors may be supposed to intersect in a point: take this point as the origin, and about it describe a sphere passing through the object. It is easy to see that the images of this object after any number of reflections will always be on the surface of the sphere.

In the case of the four mirrors used in the range-finder, O being the centre of the sphere, and P the object, let OX, OY, OZ (Fig. 6) be three axes at right angles to one another, also let A_1 and A_2 be the points at which the first and second mirrors, M_1 , M_2 , respectively cut the quadrant Z, -X of the sphere, and Y the line in which their planes intersect.

The angle $A_1OA_2 = \frac{\pi}{4}$ by hypothesis, therefore the image of P in M_1 will be at some point I_1 in the quadrant -X, -Z, and the image of I_1 in M_2 will be at Z from the property of double reflection.

Let A_3 , A_4 be the points where the third and fourth mirrors M_3 , M_4 cut the quadrant X, -Z, and if M_3 , M_4 intersect in Y, and $A_3OA_4 = \frac{\pi}{4}$, the image of I_2 in M_3 will be at some point I_3 , and the image of I_3 in M_4 will be at P, coincident with the object.

To examine the effect on the position of the image I_4 , of rotating one pair of mirrors about Z (the axis of the base): Let the axis of intersection of M_3 , M_4 , be OY' (Fig. 7), making an angle θ with OY in the plane XY. Then I_3 and I_4 will lie in the great circle through Z and X', making an angle θ with OX, and since the image I_2 makes an angle θ with the plane Z, X', -Z, I_3 and I_4 will be also inclined to Z, X', -Z, at this angle. I_4 is therefore displaced through θ in the plane XY, and rotated through θ about the axis X'O; or in other

words for small values of θ the image I_4 moves as if it were carried by a rigid arm about a centre in the plane ZX whose co-ordinates are $X = PO, Z = -PO$.

Next take the case of one pair of mirrors being rotated about OX (the axis of the telescope).

Let $Y''O$ (Fig. 8) be the intersection of the second pair, and let $Y''OY = \phi$. I_2 is distant ϕ from the great circle $Z'', -X, -Z, P$, which is in the plane perpendicular to the planes of the altered mirrors, therefore I_3 and I_4 will also be distant ϕ from this plane; and since at I_2 the great circle through Z'', X , is parallel to that through Z, X , the images of $I_3'' I_4''$ will make the same angle with the plane $Z'', X, -Z''$ as P or I_1 or I_2 do with $Z, X, -Z, P$.

Hence since $Z'', X, -Z'', P$, makes an angle ϕ with the plane Z, X, Z, P , the image I_4 is rotated through ϕ , and we have already seen that it is distant ϕ from the plane $Z'', X, -Z'', P$.

Hence rotation about OX for small values of ϕ give a displacement and rotation of the image, each equal in amount to ϕ , and attending to the signs of these quantities, we see that the co-ordinates of its centre of motion are $X = OP, Z = OP$.

If right-handed rotation is taken as positive, it will be further seen that calling angular motion about Z, θ , about X, ϕ , and about Y, ψ ,

$$\left. \begin{array}{l} \text{a rotation } \theta = \alpha \\ \phi = \alpha \\ \psi = \alpha \end{array} \right\} \left\{ \begin{array}{l} \text{of the mirrors for} \\ \text{small values of } \alpha \end{array} \right\} \left\{ \begin{array}{lll} \theta = -\alpha. & \phi = -\alpha. & \psi = 0. \\ \theta = \alpha. & \phi = -\alpha. & \psi = \alpha^2. \\ \psi = \alpha \text{ (for any value of } \alpha) & \theta = 0. & \phi = 0. \end{array} \right.$$

It should be observed that whilst in the case of rotation about Z , the image I_4 remains in the plane XY , this is not the case for the rotation about X , the image in the latter case being distant from that plane by a quantity α^2 . For this reason sideways bending of the base is objectionable, although the error introduced is of the second order.

The CHAIRMAN: We shall be happy to hear anything that Major White may have to say on this subject.

Major WHITE: It seems to me that anything we might have had to remark in the way of criticism on this paper has been anticipated by Mr. Mallock himself, so that I have really nothing to say. In the last discussion I was talking about something that I had tried, and was speaking from personal experience. This is quite a new instrument, and so far I think rests almost entirely on theory. It is, however, a very interesting proposal, and I should like to hear something more about it.

Captain C. B. MAYNE, R.E.: Sir, if the range-finder that has just been described really has all the advantages which have been claimed for it, I think Mr. Mallock may be congratulated, for it is an instrument which will be found very valuable for infantry purposes in the field. I do not see why one or two of these range-finders should not be carried by each company. There is no greater difficulty in the use of it than in holding up a rifle. It certainly has a great advantage, as I pointed out just now, that other range-finders have not got, namely, that you have one base with which you can take several ranges without having to alter the direction of your base. I think that is the great fault of all the other range-finders. With this range-finder you have no pacing up and down the line under fire; you can get behind a wall or any other cover that exists and take your range. Of course this is the first time that I have seen it, and speak without having tried it. Mr. Mallock has

given an account of some very remarkable trials, and I think his figures show what Major Featherstonhaugh pointed out, namely, the great difference there is between a single error and the mean of errors. The mean error of the first range was 6 yards over the true, but the greatest error was 94 yards, and I think that all range-finders should be tested by the greatest error that they give. I think that Mr. Mallock should design his instrument separately for artillery and infantry purposes, and in the latter case ranges suited only to infantry fire, of which the limit is about 1,500 yards. That is about the maximum. If Mr. Mallock would make his instrument shorter, so as to suit that range, and still find the range within 50 yards,¹ I think we should have a perfect infantry range-finder. The other day I wrote about range-finders, and a friendly critic said I had laid down too hard conditions. I find that instead of my conditions being too hard, Mr. Mallock has satisfied them all, and gone beyond what I expected in their use. I can see another use for an instrument like this, for rough military eye sketches, as certainly it gives ranges with sufficient accuracy for that purpose in the field. Supposing that you have to reconnoitre your enemy's position without a compass, you can take your distances as you go along without any trouble, and get results quite within the limit of errors allowable. If that instrument is subsequently found to answer I think it is a pity it has not been kept confidential, and kept for our own Army.

A MEMBER: What is about the cost of the instrument?

MR. MALLOCK: That is the only one that at present exists, and I am afraid to say what it costs.

A MEMBER: What is the weight?

MR. MALLOCK: This instrument is rather heavy; it weighs 5 lbs.

MAJOR FEATHERSTONHAUGH: A similar idea occurred to me some time ago, and I tried it, though not so well as Mr. Mallock has tried it. I then found the difficulty was that I could not get the object into the upper field of view, because the field of view is very small.

MR. MALLOCK: You cannot help getting it with this instrument, the two things are bound to be together.

MAJOR FEATHERSTONHAUGH: With regard to the errors of range the greatest deviation from the mean of 2,300 yards is 94; that is not very small; but when you look at the last range, 2,800 yards, only 500 yards greater, you find the greatest deviation from the mean is 227 yards.

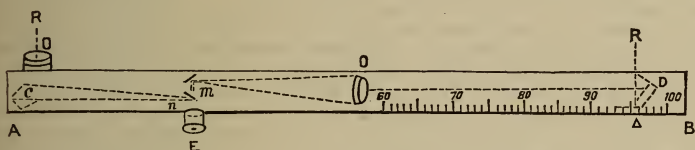
MR. MALLOCK: It is perfectly true; as you get on the percentage of error increases, but that is rather an exceptionally bad observation, and no doubt a man who was observing, and found that he had one exceptionally bad observation, would throw it out.

THE CHAIRMAN: I will now introduce to you Mr. Adie, the well-known instrument maker in Pall Mall. Many years ago he constructed a telemeter, which in principle is very similar to this one of Mr. Mallock's, though different in details. You will probably like to hear what he has to say about it.

MR. ADIE: I need scarcely say anything about this instrument, the first telemeter; it is pretty well known, I think. It is very portable and has one advantage which I think Mr. Mallock will recognize at once. In observing with this instrument you have simultaneous observations with two telescopes, and the image is divided into two, so that whatever your object for observation, whether the side of a house, a chimney, or a man, you line any straight or even curved line of said object with itself, greatly preferable for accuracy to covering the object by itself. There are two telescopes: one works into the upper part of the eye-piece and one works into the

¹ Or rather, as pointed out in the footnote on p. 513, 100 yards, and to within 50 yards at 1,000 yards. The artillery could easily use a much longer range instrument, as it could be rested across the two wheels of a gun or held on a stand, but it is doubtful whether the instrument will be of any use at all to artillery, which will have to open the fight now-a-days at ranges over 3,000 yards and even up to 5,000 yards at times, and to know its ranges exactly, if any result is to be obtained from its fire. One point that has not been referred to in Mr. Mallock's instrument, and which should be noticed, is the extreme rapidity of taking ranges with it—ten estimates were made in from two to three minutes only! A very great advantage.

lower part, and that enables you to read to two seconds instead of ten seconds. The limit of the instrument is of course the power of the telescopes. It is a very compact instrument, and I have the longest possible telescope for the length of the instrument. With this small size I can read to five seconds, or even less than that, and with the 3-foot of course I can read to two seconds. This instrument has been applied a good deal in civil surveys in measuring inaccessible distances, &c. A short time ago Major Featherstonhaugh brought a suggestion to me which has dwelt very much on my mind ever since, and which I think ought to be brought into use. He suggested that instead of the scale I should adopt a double mirror, shifting the position of the second object-glass to the end of its tube, and by that means get rid of the great difficulty of flexure by sun's rays or otherwise, and also reducing the work and so the cost, while the length of the base is easily increased, and the reading upon a common scale more simple. Reference to the diagram below will



better explain how this is arranged. AB is the base, square by preference, which for illustration may be called 10 inches in length, OO are the object-glasses of the two telescopes directed by the intervention of the mirrors D, c, m, n, when observing to the same object, the rays coming in the one are in the direction R, D, O, m, E into the upper half of the eye-piece E, and in the other case in the direction R, O, c, n, E into the lower half of E, then if the scale is in the proportion of one-tenth of an inch to 100 yards, a coincidence of the parts of the image when the mirror D stands at 100 on the scale shows the distance of the object to be 100 yards, at 90 on the scale 90, and so on. Unfortunately I have not yet carried out the suggestion, but I mean to do it. I think it would be a very neat thing, and I am much obliged to Colonel Featherstonhaugh for suggesting it. I may mention that forty years ago a gentleman, now a patent agent, and in a very good position in that profession, came to me to make a range-finder for him, which he thought he would patent. It was that very thing made in this way: he had one telescope at the end at right angles to the base, and he had a single slide mirror sliding along the base, but the exceeding difficulty of making or keeping the base absolutely straight rendered accuracy impossible, otherwise it would have been a very nice instrument. I think a telescope at right angles is rather an objection, being less convenient for observation. The double mirror instead of being made a double mirror might be made a solid prism, keeping the two faces of entrance and exit at right angles to the rays.

Captain MAYNE: What is the range?

Mr. ADIE: This gives a scale up to a thousand on the instrument, and a printed scale going up to 2,000 yards. The larger instruments in like proportion.

Major FEATHERSTONHAUGH: I did use one of Mr. Adie's telemeters in India up to 1,000 yards. I used it as a position-finder, and not as a range-finder.

Mr. ADIE: I first used double reflecting prisms, but found them very difficult to fix. I afterwards used speculum metal reflectors, and found them a very great improvement; in fact, that was the real objection practically to the instrument, that it required to be tenderly dealt with. I have always maintained the simplicity of this instrument, because I can take an observation in five seconds. I can take a man on horseback at 3,000 yards, and come up to about 100 yards of the true distance with the 3-foot instrument.

The CHAIRMAN: Gentlemen, I have had a little experience with Mr. Adie's instruments myself, and in theory I admire them very greatly indeed, but I am bound to say that when I lent one to some Officers in India to use for range-finding, they could make nothing of it. I believe this was mainly due to the fact that the Officers themselves had not been trained in its use. If an instru-

ment of this kind were to be sent to the School of Range-finding under Major White, and put in his hands, I dare say in a very short time he would teach his Officers how to use it properly; but unfortunately I had to put the instrument in the hands of men who had first to find out how to use it. Another instrument I placed in the hands of Major Featherstonhaugh, and he soon mastered it, and got very good results indeed from it. Mr. Adie made a telemeter for me, which was a little different in construction from the one now exhibited. Instead of having one of the telescopes in a movable arm on one side, both the telescopes were fixed, and you saw two images of the distant object in the centre prism. There was no attempt to make the images lap over each other, as in a sextant; they were purposely looked at as two separate objects, and the distance between them was measured with a micrometer, as in Mr. Mallock's instrument. This is the method that I should personally prefer, but those who are accustomed to the use of sextants and reflecting instruments will probably prefer the original method. I experimentalized with the instrument, and came to the conclusion that although the design was very beautiful and ingenious the metal frame was too thin and flexible, and thus the adjustments were not sufficiently permanent. They were, moreover, very difficult to execute. The instrument was covered over with a leather case, and this case had to be wholly removed in order that the adjustments might be effected. I had them made by setting the instrument on the sun, for I was in Calcutta at the time; the atmosphere was very hazy and thick, and there was no seeing distant opaque objects. The sun of India is of course trying, and it told on the thin metal frame of the instrument; thus after the adjustment had been made, and the instrument was put back into its leather case, and allowed to cool down, it was found to be much out of adjustment. I think, however, that an instrument of the same kind, but with a more solid frame, would be found to answer very satisfactorily, and would be better suited for rough work in the field, and to be entrusted to soldiers. We have had a very interesting afternoon, and I am sure you will all join with me in returning thanks to Mr. Mallock for the valuable paper he has read to us. More than one of the Officers now present who are familiar with range-finders has told us that he either never heard of or has never used a range-finder constructed on the principle of Mr. Mallock's and Mr. Adie's instruments. I think it will be a very good thing if Officers who are in a position to learn and teach others how to use these instruments would avail themselves of their opportunities to give them a chance of being thoroughly tried and tested.

Friday, March 26, 1886.

REAR-ADMIRAL W. ARTHUR, C.B., Member of Council, in the
Chair.

DESCRIPTION OF THE "REMINGTON-LEE" MAGAZINE RIFLE.

By Major ARMSTRONG, late A.P.D.

INTO the general question of repeating or magazine small-arms, which is still becoming daily of greater extent and importance, I do not propose to enter; most of my hearers know quite as much of it as I do. But I may say that, apart from the considerations which are common to all military rifles, such as breech-action, calibre, trajectory, &c., the desiderata in general as regards the magazine system, whatever it is, may be considered as narrowed down to the getting rid of the four principal objections still to be found more or less in all repeating arms.

These objections are:—

1. The awkward distribution of the weight of the magazine and its charge, which is generally disposed in the way most irksome to the soldier.
2. The alteration of the centre of gravity, and therefore of the "balance" of the rifle, which follows each shot.
3. The danger of explosion in the magazine, the cartridges necessarily resting (in tube magazines) *à la file*, a danger which has been found very real and serious.
4. The practical impossibility of knowing if the magazine is really kept in reserve while the arm is being used as a single loader.

They are inseparable from all of the large family of repeating arms which carry their magazine in a tube either in the butt or under the barrel, of which classes the Spencer and the Winchester are respectively the prototypes. The third objection has been got rid of in some cases, of which, I think, the Evans was the earliest, by converting the whole butt into a magazine with spiral feeding action, at the cost, however, of enhancing greatly the second and enormously the first objection. The importance of the fourth can scarcely be overrated, from the strictly military point of view, it appears to me. The best of soldiers are naturally inclined in the excitement of action to fire away their ammunition fast, and notwithstanding the strictest orders

to keep the magazine in reserve and use the arm as a single-loader until the occasion arose for a rapid and concentrated fire, the majority in any body of men would be pretty sure to draw on their magazines as long as there was a shot in the locker. An Officer then could not possibly know whether his men really had magazine arms in their hands or not, unless he examined each arm separately, emptying from it and replacing all the cartridges.

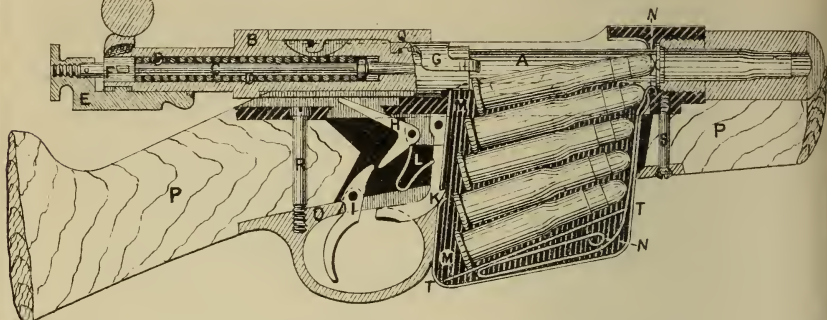
Several attempts, therefore, have been made to adopt a repeating or "quick-firing" attachment to the ordinary breech-loader, so as to convert it for the moment into a repeater, but they all leave much to be desired as regards strength, handiness, sightliness, quickness of action, and above all rapidity of adjustment and replacement; with none of them, in fact, can the result be considered really a magazine rifle. It is in this direction that inquiry and experiment are naturally tending more and more, and I think there can be little doubt the arm of the future will be the best single-loader obtainable, *plus* a good attachable magazine system.

I think you will find that practically that ideal has been attained, as regards the latter half at any rate, in the arm I have now the honour to submit to you. It is the "Remington-Lee" rifle, invented and patented by Mr. Lee, and made by Messrs. E. Remington and Sons, of New York. It is at this moment a simple breech-loading rifle, with bolt action, differing little from other bolt systems except that it is simpler and stronger than most. This particular model is of 0.45 calibre, rifled with five grooves, taking a complete turn in 20 inches; weight about 9 lbs.; and takes the United States service cartridge of 70 grains of powder with a bullet of 405 grains, giving an initial velocity of about 1,350 feet per second. And the action is particularly quick and easy, as you see.

The principal feature of this arm was brought to the notice of the Institution, along with other repeaters, in a paper on the subject generally about three years ago. The arm itself, however, was not presented to you, and since then there have been numerous improvements effected in both the breech and magazine systems; the rifle, too, has in its present form been taken up experimentally by almost every European Government, as yet without any decision arrived at.

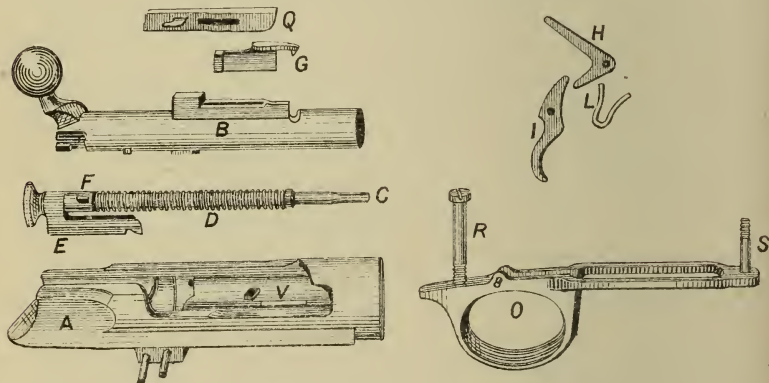
The details given can of course be varied to any extent desired in the manufacture; the important feature is the independent magazine system. The arm can be used indefinitely in its present form as a single-loader, until the necessity arises for the quickest and most concentrated fire obtainable, when it is converted in a moment, at the word of command, into an almost inexhaustible repeater of the most rapid action. Any desired quantity of reserve ammunition can be served out in the magazines which I produce, each containing five cartridges in no greater space than if they were in the ordinary paper packages. They are made of sheet-steel in one piece, with a simple spring to propel and a "carrier" to guide the cartridges, three pieces in all. They are specially contrived to combine the maximum of strength and efficiency with the minimum of cost, though if retained they can be recharged and used hundreds of times of course. The

SECTION OF ACTION AND MAGAZINE

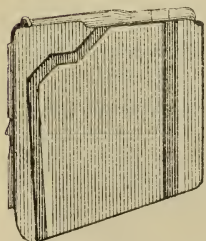


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|-----------------------|--------------------|---------------------|-----------------------|
| A. CHAMBER. | F. KEY OF DO. | L. SCEAR-SPRING | P. STOCK. |
| B. BOLT. | G. EXTRACTOR. | (DOUBLE ACTION). | R. & S. TRIGGER-GUARD |
| C. FIRING-PIN. | H. SCEAR. | M. MAGAZINE. | SCREWS. |
| D. MAINSPRING. | I. TRIGGER | N. MAGAZINE-SPRING. | T. CARRIER--FALSE |
| E. DOG OF FIRING-PIN. | K. MAGAZINE CATCH. | O. TRIGGER-GUARD. | BOTTOM OF MAGAZINE. |

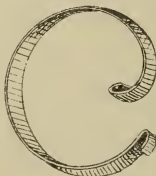
DETAILS OF BOLT SYSTEM.



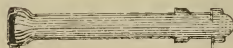
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|-----------------------|-----------------|-----------------------|
| A. CHAMBER. | F. KEY OF DO. | O. TRIGGER-GUARD. |
| B. BOLT. | G. EXTRACTOR. | Q. PLATE COVERING |
| C. FIRING-PIN. | H. SCEAR. | EXTRACTOR. |
| D. MAINSPRING. | I. TRIGGER. | R. & S. TRIGGER-GUARD |
| E. DOG OF FIRING-PIN. | L. SCEAR-SPRING | SCREWS. |



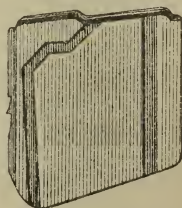
MAGAZINE CHARGED



MAGAZINE-SPRING.



"CARRIER" FORMING FALSE BOTTOM TO MAGAZINE.



MAGAZINE EMPTY.

cartridges are stowed away in them in a moment, and yet are so firmly held that it is scarcely possible to displace them unintentionally even with the roughest treatment, while as you will see the empty magazine is removed and replaced by a full one in less time than is required to insert a single cartridge in the ordinary single-loader. This quickness of adjustment is a very important feature, for though the capacity of each magazine is small, it is so easily and speedily replaced that the magazine *system* is practically inexhaustible, being really limited only by the carrying power of the soldier. The rifle has been fired from the shoulder, as a repeater, fifty times in one minute, during an official trial in America, a rate much beyond that of any other magazine arm. Such a rate indeed is probably beyond what is either desirable or necessary in practice, and is only possible to an exceptionally strong man.

To obtain the full advantage of this magazine system, it should be a detail of *administration* to pack, store, and issue on active service a certain proportion—as large as desired, it is no matter how large—of ammunition in the magazines. Taking, as I said, scarcely a greater appreciable space, and weighing little more than in strong paper packings, this reserve ammunition would then, as such, be packed in damp-proof cases like other war material; and there is no reason why the magazines should deteriorate in any way. And—this is an important point—while the soldier would of course be drilled in charging, applying, working, and replacing the magazines, it would not—as it certainly should not—be left to him to charge his magazines during action. He would, and should simply, when ordered, convert his rifle into a repeater, whose capacity as such, as I have stated, is dependent on his own carrying power *and* the administrative arrangements for keeping up the supply of ammunition in the field.

The four objections cited, therefore, do not apply to this rifle. The magazine in use offers no inconvenient projection nor unsightly feature, whilst its weight is so disposed that the centre of gravity of the rifle is never disturbed, the balance of the arm remaining therefore always the same; and the cartridges lie always side by side in the magazine, where they are really better protected from all possibility of accident than they could be anywhere else. While as to the fourth and most important objection, it is evident that the Officer can see at a glance, even from a considerable distance, whether the arm is being used as a single-loader in obedience to orders, or if any of his men has brought his magazines into play before the word of command. The charged magazines, moreover, would be carried apart from the loose ammunition until required, in separate pouches, so that to make use of them would involve a distinct and explicit drill motion.

It is not necessary for me to occupy the time of the meeting any further: I wish only to thank you for your patience, gentlemen, and will leave the rifle to your examination and criticism.

Colonel FRASER, R.E.: May I ask Major Armstrong the weight of the magazine—the iron case that contains the five cartridges?

Admiral BOYS: I have but little to say about this rifle. It seems to me to answer all the conditions which the lecturer claims for it and to be a very good

weapon of its kind. It, however, possesses the objection that was made by the first Committee that sat on breech-loading small-arms, namely that the breech action is on the bolt system, and guns loaded by a sliding bolt instead of a rising and lowering block, have generally since that Committee's report been rejected in competition in the British Service, although they are very generally approved in other countries. The block system does put many obstacles in the way of adopting detachable magazines which for rifles on the bolt system can be done with but little difficulty and expense. Of course the weight of these magazines is an important consideration when a great many of them have to be carried, and another point is that it adds considerably to the expense of a soldier's or sailor's equipment.

Colonel BAYLIS: I hope the question of expense is one that will never be taken into consideration in these matters. It is a point that we never consider as sportsmen when we go to the field shooting; and when we have the best possible weapon to kill birds, I think when a man's life depends upon it, we ought to have the best weapon, no matter what the expense.

Admiral BOYS: As an individual I quite agree, but it is a consideration with our Government as we know, and a question of even a sixpence additional expense per rifle comes up to many thousands of pounds, 50,000*l.*, or something of that sort.

Colonel BAYLIS: It may be a question of deciding a battle!

Captain CURTIS: I think in the first place this magazine adds to the grip of the gun. If you take hold of a gun or a rifle by the small of the butt you balance it, and you can press it with that magazine home to the shoulder much better, and get a steadier shot. We want efficiency at whatever cost.¹ Instead of a man having a lot of cartridges and not knowing which end he is going to get hold of first, with this magazine they are all in their place ready for use. Certainly the men should be drilled with this rifle, and should not load with the magazines till they are ordered to do so. Lord Charles Beresford told us the blue-jackets rushed to where the "Emu" was, because they thought they were wanted, but military and naval men must obey orders, and that can only be got by constant drill.² If a man has five cartridges in a magazine, and the enemy are nearly on to him, he is sure to use the magazine, and I don't blame him either. A man is supposed to carry sixty or seventy rounds, and with respect to the magazine I should like to know what additional weight it would represent: would it mean a difference of eight to ten rounds? I think it is a very pretty and handy weapon. The cartridge, too, seems a very good one. The cap is countersunk, so that the thing cannot go off by accident, as some cartridges will do where the cap projects.

A MEMBER: Are they waterproof?

Captain CURTIS: They ought to be. These, of course, are dummies, without powder or cap, but now-a-days there is no reason why cartridges should not be waterproof; the Service cartridge no doubt is.

The CHAIRMAN: I may state that we have had this magazine weighed, both empty and full; the weight of the empty magazine is $4\frac{1}{4}$ ounces, and of the full one $11\frac{3}{4}$ ounces.

Captain LUMLEY: Great stress appears to be placed on the weight of the cartridge holder, but the soldier need carry only a certain portion of his ammunition in those little cases; in fact, that amount necessary for use at the required moment, because the repeating rifle should only be used to repulse an attack of cavalry at the last moment, in defence of a position stormed by infantry, or just before making an attack on a position occupied by the enemy, when it would be of the greatest importance to be able to concentrate a mass of fire on the position before making the final charge. Under these circumstances, the proportion of ammunition carried in these cases should not exceed one-third of the whole amount carried by the soldier.

Captain CURTIS: Possibly these cases might be made lighter; they manufacture steel very strong now, and it is quite possible they could be made lighter.

¹ At Isandula the magazine-rifle would have been invaluable.

² At the Alma the Highlanders reserved their fire until within charging distance of the Russian squares and columns.

The CHAIRMAN : As a matter of fact, they are made lighter.

Captain CURTIS : It is impervious to rust, I suppose.

Captain LUMLEY : One drawback to this rifle is, that the English Government would never adopt it, being a bolt-rifle ; our Committees have always been against this kind of breech action. I have been before several Committees, and have lately seen a good many of these rifles, and the conclusion I have come to from what I have heard from Officers is, that the English Government is decidedly opposed to any bolt-rifle, and unless they can obtain a repeating rifle on the block system, they will not adopt one at all, on account of the great expense of an entirely new rifle. Naturally, as a block moves up and down it is very difficult to transform these rifles into repeaters without one motion of the hand ; but I have seen lately a rifle, the Henry-Martini, converted into a repeating rifle, where this necessity was done away with ; but on further examining it closely, I found the power of the extractor was affected. I fear if we are to have a repeating rifle in England, we shall have to adopt the bolt system and have an entirely new rifle.

Major ARMSTRONG : Before I make a rejoinder to the points that have been raised one by one I should like to state this. Of course I presented the arm to you as it stands on its own merits, but it consists of two perfectly distinct principles, the bolt system and the magazine ; I am aware that there is a very strong theoretical objection in England to all bolt-guns, but the magazine system is the important feature. I believe that it would be extremely difficult to adapt that magazine system to the Martini action. It is very much easier to adapt *any* magazine system to a bolt-gun than it is to a breech-block system. Certainly it would, I believe, be very difficult to adapt this one to the Martini-Henry. The important feature seems to me to be the magazine system. The gun is very simple and strong, and can very well stand on its own merits. I am not able to say if it is the best form, but the magazine system is the great feature. As to the weight of the magazine, which has been stated to be $4\frac{1}{2}$ ounces empty and $11\frac{1}{2}$ ounces full, I presume the five live cartridges would be of about the same weight as the dummy cartridges. I did not bring any live cartridges for fear of accident, but I can put some at the disposal of the Institution. As to the cost of the magazine I should say it would be a couple of pence only. When we come to deal with thousands of arms, these two points, the cost and the weight, are certainly important, but against the weight you must set off the advantages which this gun possesses as a single-loader. It has not got the fixed, immovable, unalterable weight of the magazine system in other magazine-rifles.

Captain CURTIS : You do not always carry the weight of the magazine and rifle.

Major ARMSTRONG : The rifle, other things being equal, is only the weight of an ordinary breech-loader. It may be made any weight you like in the manufacture, and until you attach the magazine it remains a simple single-loader. In any gun with a fixed magazine you must add the weight of the magazine action, so that the weight of four or five of these magazines in which the reserve ammunition is served out to the individual soldier is probably, other things being equal, counterbalanced by the extra weight in another magazine-rifle of its magazine system.

Captain LUMLEY : You carry the weight in your pocket instead of on your shoulder ?

Major ARMSTRONG : Yes. You do not carry the magazine in your pocket on the magazine system ; I am speaking now of other magazine-guns.

Captain LUMLEY : There are some other magazine-guns on the same principle.

Major ARMSTRONG : Of what are the magazines made ?

Captain LUMLEY : Tin.

Major ARMSTRONG : It becomes a matter of practical experience whether the tin is to be trusted. Captain Curtis alluded to the additional grip, which would be, perhaps, of more importance in a sporting gun, which would be naturally shorter than a military gun. With a long gun like this the man would need to have the support of his left hand thrown well forward. With a sporting gun it would be an advantage, it would give a stronger grip to the left hand.

Admiral BOYS : I should like to ask whether this system of magazine is not

adapted to several other descriptions of bolt-guns, magazines precisely of that nature?

Major ARMSTRONG: I do not know: the arm as it stands now is patented in every European country and in America. There are some similar magazine systems adapted; I have had very little experience in these matters theoretically or practically, but I do not myself know of any in which the magazine is attached exactly in this position. The Burton is one in which the magazine is attachable at the side and projects very awkwardly, the cartridges as far as I can understand being dropped into action as required by their own weight. But that magazine as far as I could judge was necessarily very much more solidly fixed than this system requires, in fact it appeared to be a solid part of the gun. I had not, however, an opportunity of handling or working it.

Mr. BURTON: I would like to explain with regard to my gun, that the hopper is not a permanent fixture, as stated, but is made to be carried on the soldier's waist-belt, and it is capable of being applied or removed at will in less than 10 seconds; this hopper carries 10 cartridges, and when fired off the hopper can be re-filled in 10 seconds. Another of my improvements consists in packing the cartridges in tin boxes of ten each, "tin boxes being as cheap as paper." A short hopper is placed on the gun, which owing to its size may be made permanent, or, like the former, removed at will. The lid of the tin box is removed, and the tin box placed in this hopper, mouth down, when the cartridges feed down by gravity into the gun as the preceding one is fired off. When all the cartridges are fired off, the empty case is removed and thrown away. Another full box replaces the spent one; to do so requires not more than a few seconds. Those hoppers are made of steel, and so strongly secured to the gun they cannot be broken off by a blow of a sword. The latter hopper carries five cartridges, and one in the barrel; if used independent of the tin boxes, it stands but little above the gun, and does not interfere with the manipulation of the gun. I wish to say that the Lee gun before us is an infringement of my patent, and cannot be made without infringing my patent.

Major ARMSTRONG: I am glad to hear your first remark, and sorry to hear your second, but as I said I have no theoretical, and but little practical experience in these matters. I saw your gun once, but I never handled it that I am aware of.

The CHAIRMAN: Before we close the subject I should like to make a few remarks. The objection to the bolt ferreture for rifles appear to be quite confined to England. I do not see that we are called upon to adopt that objection. It is principally caused by the number of accidents that have occurred in catching the bolt on closing the breech. The firing spring is caught on a little catch when drawn back, and the catch is transferred to the trigger lever on closing the breech. In making the transfer the gun is apt to go off, but that does not occur very often. Bolt-guns are of various kinds, and in some this difficulty has been overcome. Of course we have seen the Lee magazine adapted to several other guns, but we cannot here go into the question of patents, it is far beyond our province. This magazine has lately been made lighter; it has been made of ebonite, and in the United States it has been made of paper, and I believe I am right in saying they have reduced the price to about $1\frac{1}{2}d$. They are so cheap that they may in action be thrown away after having been used. Of course at general exercise you might retain them for re-filling. The weight is of course a consideration; it adds about a pound to your magazine. This is an addition, but you must have magazines for your magazine-gun, but generally you have one magazine, which is re-filled from the pouch, and here for your fifty rounds you have ten magazines. This is no doubt a drawback. I should like to know whether these are exact models of the cartridges.

Major ANDERSON: These are exact models of the United States Service cartridge.

The CHAIRMAN: It is a service cartridge manufactured for the purpose of avoiding the difficulty which you mentioned; the cap is so thrown back that the point of the bolt does not catch it.

Major ANDERSON: There is no cap in it. The cartridges rest in the magazine, so that the bullet in one cartridge never touches the cap of the other.

The CHAIRMAN: These cartridges are, I believe, constructed with the express purpose that the bullet shall be in the recess, in order to obviate the danger of

ignition from the point of one cartridge striking the cap of another in tubular magazines.

Major ANDERSON : I am not quite certain about that ; it is the United States cartridge.

Mr. BURTON : I would like to call your attention to this cartridge I hold in my hand, which I wish you to examine ; it is so constructed *that all danger from premature explosion is entirely overcome*, it can only be ignited in the gun, or unless struck by a blow by a pointed instrument, through the hole in its base. It may be re-loaded like others, the cost is the same. All my efforts to induce the Government to adopt it failed ; they would not even consider it, as it did not emanate from Enfield.

PAULSON'S ELECTRICAL AUTOMATIC LOCOMOTIVE TORPEDO.

By Mr. R. PAULSON.

BEFORE I enter into the subject of my paper I must ask the members to indulge me for a few moments. I feel that I address this meeting rather at a disadvantage. In the first place I am a stranger, and, therefore, should I unwittingly transgress any of your rules, I hope due allowance will be made. Secondly, the subject I am about to deal with requires rather careful handling, and I feel rather at a loss how to proceed when I stand before you to describe a weapon in only a broad, imperfect, and crude manner ; for although I am fully prepared under proper conditions to prove that the assertions made in my paper can be carried out in detail, still for obvious reasons it would not be good policy on my part to disclose those details, a torpedo being a weapon that can be and is made secretly.

In commencing my paper I must tell you that I make three distinct torpedoes. One of these, very small, simple in construction, and cheap, 12 feet long by about 12 inches in diameter, used for the destruction of an enemy's mines or in case you want to enter a harbour. This torpedo can be steered automatically, aided by clock-work, so as to run for a certain distance in a straight direction, then to go serpentine or in circles until it comes within the attraction of a mine, when it will be steered towards it, and will explode on contact ; I do not propose to put any engines in that torpedo.

The second point of my invention refers to improvements in constructing and working the Service torpedoes. The apparatus weighs about 7 or 8 lbs., and will automatically steer a torpedo in any direction. It may be fitted to the present Service or Whitehead torpedo, and also to submarine or torpedo-boats, and I claim that aided by this and *other* improvements, the speed will be increased about 25 per cent., the explosive power used, although the same weight for weight, is quite as safe, but fifty per cent. stronger. This I have proved in a very simple manner. I have also two systems of overcoming the protection provided by nets, that can also be fitted to the Whitehead or other torpedo.

The third torpedo is the one which I make about 25 feet long, and is used solely for coast defence. This weapon travels at a greater

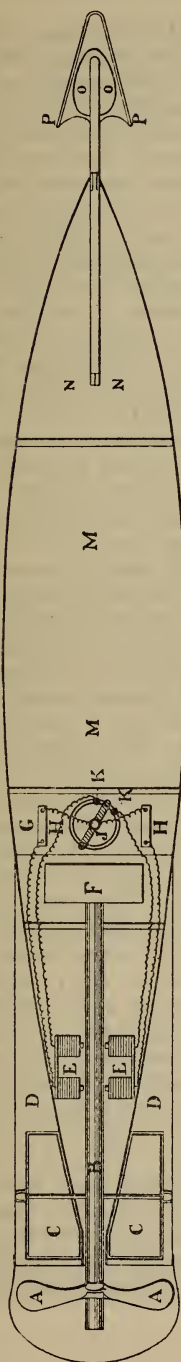
speed than has yet been attained by any torpedo, it carries more motive power, and also a very destructive explosive, very powerful but not too powerful, that is to say, not so destructive that it might injure friendly torpedo-boats that happened to be too near, because if too large a charge were used it might crush in the sides of a submarine-boat, but it would still be sufficient to destroy the largest iron-clad. This torpedo may either be steered automatically or controlled from the shore part of its course.

The cost of the small torpedo to which I first referred is about 100*l.*, and the cost of fitting my complete arrangement to the Service torpedo would not exceed 15*l.* I will now proceed to more particularly describe the improvements. The working pressure can be increased to 1,500 lbs. per inch, which is also maintained during the entire run; when the torpedo is checked or nearly exhausted it comes to the surface. This improvement can also be applied to the Whitehead and other torpedoes.

Another of the principal features of the torpedo is the arrangement by which it steers itself automatically in any given direction, in a direct line, independently of its being launched straight, and of adverse currents, or of any deflection accidentally caused. In carrying out this arrangement electric contact is made through and by means of a suitable compass. Now I am well aware that to merely make such contact so as to ring an electric bell has been done before, but on trying that system I found it did not answer at all; it had to be greatly improved, and what I claim in my patent is the automatic steering of torpedoes, which has never been done before. Other torpedoes have mostly been steered or controlled by wires from the shore, but automatically never. This torpedo also carries a battery, the negative pole of which is placed in connection with the coils of two sets of electro-magnets from which leads are conducted to two metal pins fixed on a disc of insulating material. The other pole of the battery is placed in communication with a balanced magnetic needle of special construction. The metal pins are placed one on either side of the needle, and the course of the torpedo having been determined and set, it is started. Any deviation of the torpedo from its assigned course causes a relative movement of the needle which touches one or other of the pins, thus establishing the circuit through the coils of one or other of the two magnets. An armature connected with the rudder is attracted, and by this means the torpedo is again placed in its right course when the contact is broken. Any deviation from the right course in the case of the controlled torpedo is immediately indicated to the persons so controlling it, and also its course from time to time.

[Mr. Paulson now explained, by the aid of the model before the meeting of a small bronze torpedo about 30 inches in length, mounted on a swivelling stand, with electric wires and a bell, that any deviation from the course the torpedo is set to run was indicated by the ringing of the bell. Each blow on the bell would represent the deflection of the rudder, and the continuous ringing of the bell indicated that the rudder was set hard aport or starboard as the case might be.]

PAULSON'S IMPROVED OR AUTOMATIC TORPEDO.



Horizontal Section.

A.A. Screw propeller. B. Propeller shaft. CC. Horizontal rudders. DD. Fins. EE. Electric magnets. F. Engine. G. Secret chamber. HH. Batteries J. Steering compass. KK. Studs connected with electric batteries HH and electro-magnets EE. MM. Motive power chamber, 1,500 to 2,000 lbs. pressure. NN. Explosive charge. OO. Smaller charge for breaking nets. PP. Triggers.

One very important point is the compass. Its power of attraction must be much greater than the ordinary compass; that was a very difficult point to deal with. The magnet in the first instance was made very heavy; then I found the friction on the point, when suspended, was so great that the earth's magnetic force was not sufficient to properly work it. There were many similar difficulties that had to be overcome before a compass was obtained that would perfectly answer the purposes required. The outer case of the torpedo may be partly made of compressed strong waterproof paper or fibre, and is thus not affected by climatic changes or long storage. The construction of the various other parts is extremely simple. The battery can be stored any length of time; it weighs under 2 lbs. and will last about two hours without recharging, giving off 8 volts, or it will keep a small electric lamp glowing for that time. This automatic steering arrangement can be also applied to unmanned torpedo-boats or submarine vessels generally.

With regard to the protection afforded by torpedo nets, in my patent I show a small charge, about 10 lbs., carried in front of my torpedo; that is also a speciality that I claim. I am told that a torpedo fully charged has been fired to test the best nets in use in the Royal Navy, and the result was that a hole 40 feet in diameter was made in the net. I am also told that if you *merely suspend* 33 lbs. of gun-cotton on the present Service torpedo nets, it will not destroy, but only bulge them out; that is because it was merely loosely suspended. But if you have 10 lbs. of gun-cotton in front of a torpedo travelling 25 knots an hour, the result would be to cut the nets, even though they were almost as thick as a cable, as they would not then be loose, but made taut from the force of the blow given by the torpedo itself and at the moment of the explosion. The range of the torpedo, as I improve it, is from 1,000 to 2,500 yards, and its speed 25 to 30 knots. It travels almost noiselessly through the water, and the depth can be accurately and uniformly regulated. The counter may be so adjusted, if required, that should the torpedo fail to strike the object, it can be made to return to the starting point without risk of exploding. Besides steering automatically, it may also, if desired, be controlled by means of a wire, somewhat on the Lay plan, from a torpedo-boat or from the shore, for part of its course, and liberated when within easy striking distance of the object, the operators being quite out of the range of discovery by the enemy's electric search light.

[Mr. Paulson also explained that his torpedo defies capture by any of known methods. It may be fired from any open boat or from the shore (without a torpedo-boat), rendering it therefore valuable for coast and harbour defence; also for the protection of our Colonies and coaling stations, as it does not, moreover, require specially trained torpedo Officers for the work.

It was also stated that a torpedo upon this principle has already been made and fired on the Norfolk coast, when most of the results now enumerated were ascertained, and several distinguished and experienced naval Officers, who have had the invention explained to them, have expressed themselves highly pleased and satisfied with its merits.]

Captain CURTIS: I wish that some of our younger Officers were here who are acquainted with torpedoes. I have not been afloat with them, but I understand Mr. Paulson to say that they may be either automatic, or controllable from the shore. Do I understand, in the first place, if you want to go north, you put that indicator north, and the torpedo is supposed to go on that course irrespective of any wire?

Mr. PAULSON: That is so.

Captain CURTIS: After it has once started, you have no further control over it.

Mr. PAULSON: No further control.

Captain CURTIS: I think that is a very doubtful advantage. You tell us that if the torpedo does not hit the ship, it comes back again by some kind of attraction. I understood that if it missed the ship, it took a devious course, and came back to the vessel again. I also understand that if it does not strike the ship, it remains afloat. I think it would be very awkward for you to cruise amongst your own torpedoes, because you might come against one of them, and it might explode. I understand that there is some magnetic attraction between that torpedo and soft iron. If so, that attraction must be very great to overcome what we call the deflective wave. I recollect when I was a youngster I tried to get ashore at Mont Junk at Barcelona; the water was very deep, and really you could not get the dingy alongside the shore; the deflective wave drove the boat off, and you had to be pretty smart when the boat took the rise in order to jump ashore, because the boat was repelled back. I have heard of a case where a ship was saved from a rock off Cape Doro, in Greece, by the rebound of the wave; it is very often the case that the rebound sends the ship back. We often hear of people being drowned, although they can swim, because they cannot reach the shore, on account of the reflux wave, note particularly at Dungeness. I was going up the Channel on one occasion, when a man with delirium tremens jumped overboard; the paddle-wheel came down, and instead of sucking him under, according to popular idea, the water which was deflected drove the man away. I was so interested in this, that next day I got several empty bottles, and I could not by any means get the paddle to go over any one of them, they were all driven away by the deflecting wave. I believe Officers say that if a ship is going 14 knots, and a torpedo-boat is going 19 knots, the proper mode is to attack her bow, because in that case the torpedo-boat will be less likely to be under continuous fire. But there is another way of looking at it; if you fire on the quarter of a ship, the following water will suck the torpedo under, but a boat coming up on the quarter or stern will be under continuous fire. With respect to this deflective wave, the French say that at their torpedo experiments all the torpedoes struck, but we were also told that the weather was very calm, and that the state of the sea was not to be compared to Bantry Bay during the experiments there. I did hope that we should hear some lecture from our Chairman with regard to Bantry Bay, but whether it is intended to keep the information there acquired a secret or not, is best known to those concerned. It was stated (I believe this is no secret) that the "Polyphemus" had her nets out when she attacked the boom.

The CHAIRMAN: That is so.

Captain CURTIS: There is no doubt that the net is the cheapest protection you can possibly have, but although a net can break up a sea, it cannot stop a sea. It is just the same with your cable; you can break the cable because of the resistance that it gives, but a torpedo-net gives less resistance, and yields. It is a well-known mechanical principle that a thing may yield, and you cannot blow it up, whereas if it offered more resistance you would break it up. There is no doubt that this is an extremely ingenious invention, but I do not see after you have set the indicator north and south, as the case may be, that you have any control over it. There may be something in the attraction of a ship, but you may depend upon it that the deflection of the water, and the force of the water, is something terrific. I believe that the transmission of force through water is almost simultaneous with the force itself, because it travels 600 yards in a second of time, as quickly as sound. At the earthquake in the Straits of Sunda, it was found that the earthquake wave travelled at the rate of 1,250 miles an hour, and that is one of those things that naval Officers

should take into consideration. When I was afloat, we knew very little of the theory of turning ships, and so forth, but Captain Colomb has made a study of this, and has reduced it all to writing. When I was afloat, we were not allowed to have the courage of our own opinions; our superiors always knew better than we.

Mr. PAULSON: I may say in reply to Captain Curtis that he is quite correct in saying that if you set this torpedo on a given course, after it has left your hands you have no more control over it. The torpedo is automatic in all its details, unless it is controlled by a wire. But if I set her north, and she travels north, I can set the counter that regulates the distance and cut-off valve, so that it will turn the compass-card south; electric contact will then be made until you get the torpedo's head south, and this causes it to return to its starting point. Now, gentlemen may understand what I mean by "returning on her course." Or this can easily be done by clockwork; I can set a clock inside, and so arrange it that the torpedo shall travel say 1,000 yards in so many minutes and seconds, and then be made to return as before. If she has passed the vessel aimed at, the counter might be made so as to put a safety-bolt between the projecting trigger and the charge, so that if she struck in returning one of her own vessels, an explosion would be prevented. It simply shoots a safety-bolt, just in the same manner as pushing a safety-bolt on the lock of a gun. There has been a good deal said about attraction. I do not know whether H.M.S. "Polyphemus" did deflect the torpedoes at Bantry Bay. I have not proved whether the attraction of an ironclad would be sufficient to deflect my steering compass, and thus the torpedo; some naval Officers have expressed one opinion, and some another.

Captain CURTIS: The suggestion was ignored in this Institution by a torpedo Officer, who would not take it into consideration at all.

Mr. PAULSON: Then about the nets; I maintain that so long as a net is perfectly loose, it would be very difficult to get through it; but when you have a torpedo weighing 500 lbs., the force of that torpedo would stretch the net, and make it as taut almost as if it was a cable. Then it could be cut even by the explosion of a very small charge of guncotton, as a thick wet blanket which if loosely suspended will stop a bullet. Something was said about the vessel's speed deflecting torpedoes. I should say a great deal depends on the shape as well as the speed of the vessel. I know the "Polyphemus" went about 18 knots, but I should be surprised to hear she could do anything like that speed when she had her nets out. I am well aware that water will transmit power, and if you explode guncotton under water, you may feel the shock a mile or a mile and a half off. A gentleman told me the other day that he had got some guncotton, and as the acid made it rather dangerous, he took it down to the Thames in order to get rid of it. He said there was a vessel nearly a mile off, and after the explosion she signalled to him that some of her plates had started, which made her leak. The gentleman said he did not believe it, but anyhow they seem to have felt the shock. My own belief is that if Mr. Nordenfelt exploded his torpedo and 300 lbs. of guncotton under water, his own submarine boat would, if anywhere near, be completely crushed up. I need only now, in conclusion, thank you very much for the kind attention you have given to the subject, and hope that you will pardon me for having detained you so long.

The CHAIRMAN: The lecturer has just alluded to the area of explosion. I should be glad if he can tell me whence he gets his dimensions of the area of explosion.

Mr. PAULSON: From Professor Abel's own reports. You will find them all published; they are approximated over a given distance.

The CHAIRMAN: I was with Professor Abel at the time these experiments were carried out, and half-a-mile is far beyond anything that he attained at the Spit-head trials. The area of explosion of torpedoes is in the form of a very oblate cone. It sometimes extends horizontally for 300 yards at the bottom of the sea, but it comes to a very fine point on the surface, so much so that a boat 20 feet off is quite safe. The torpedo explodes, and the column of water is thrown up through a very small opening in the surface of the water. The explosion seems to have a double effect, at first when the torpedo explodes a narrow column of water is thrown up 60 or 70 feet. Then if you watch you will see a second but much broader column of water come to the surface having a diameter of from 40 to 50 feet.

This is the rebound of the wave against the bottom, and the rapidity with which it follows the first column depends on the depth of water. It is with this second wave that all the dead fish and the mud comes up, the first one being perfectly pure. The wave from the ship's bows which affects the torpedo is not an imaginary thing. If you fire a Whitehead torpedo out of the bows of a vessel at an angle of 7° on the bow, if it is a certain height above the water the bow of the torpedo enters the water first. You see the wave take the bow, throw it off from the keel line, and then as the stern takes the water afterwards, the stern is thrown round, and thus generally directs the torpedo nearly right ahead. In the same way if you fire right ahead with the Whitehead broad from the bow it drops into the divided waves, this wave first carries the bow round, and then carries the stern round. It will come round about 5° in the opposite bow; that shows the wave does affect it, but if the stem and stern enter the waves simultaneously the deflection will not take place. The power of compressing fibre is a very well-known fact. Compressed fibre is now used in the United States for the tires of railway carriages. It is compressed at something like 9,000 lbs. to the square inch, and stands a great deal of wear. I do not think it has been made sufficiently thin to construct a torpedo of, but I do not say that such is an impossibility. As regards holding a wet blanket up before you, I never met any one who ever held a wet blanket up before him, and allowed any one to fire at him through the blanket, and I rather think that if any one tried it I should not meet him again. The attractive power of ironclads enters into a great number of people's heads. The formula for attraction is as the cube of the distance, and therefore you may imagine that a very little way off from an ironclad there would be no effect whatever on a compass. Although the ironclad is a very powerful magnet, yet you may safely say at 120 yards it would not affect any compass whatever, or even the most delicate electrical instrument. I will not take up any more of your time, but I think you will all join with me in thanking Mr. Paulson for his interesting paper.

ELECTRIC GUNS AND AMMUNITION (RUSSELL'S PATENTS).

By (the late) W. SEYTON.¹

THE application of electricity as a means of igniting gunpowder in the cartridges of small arms is not a new idea. Several patents have been taken out for this purpose during the last twenty years, not one of which has been hitherto found to be of any practical use in the field.

Prior to the dates of the patents of Dr. Russell, the inventions embodying the use of electricity in military and sporting guns have been of two classes.

In one the cartridge contains a platinum wire, one terminal of which connects through the barrel and breech with one electrode of the battery, while the other electrode is connected to a sharp needle or firing pin, which when pushed forward by the pull on the trigger, or pressure on a button, penetrates the cartridge and its charge of powder until it touches the other terminal of the platinum wire, thus completing the circuit and firing the gun.

¹ Mr. Seyton was killed the following week, being shot through the heart by an unintentional ignition of an electric cartridge.

In guns of the other class the cartridge has two exterior contact terminals upon its base, both insulated therefrom, which in loading the gun have been made to touch respectively two corresponding contacts on the breech-block of the gun, the latter forming the terminals of an open circuit to be closed by a push-button or key in order to fire the gun. These inventions, however ingenious, are impracticable, often unsafe, and the battery arrangements and connections cumbrous and complicated.

The object of the Russell patents is to provide an electric gun which shall be practicable for ordinary use, and, while retaining the external form characteristic of the ordinary gun, to be simple in construction, certain in its action, and entirely free from danger.

With this view the firing pin is made to touch the centre of the base of the cartridge, instead of penetrating it, and the breaking of the circuit and locking of the trigger is provided for automatically, so that the gun cannot be fired after being loaded until the trigger has been released by a distinct preparatory movement.

The electricity is evolved by means of a small battery in the gun, and is communicated in a simple and effective manner to the igniter in the cartridge shell.

While maintaining the exterior form of the present arms, and also the trigger, firing pin, chamber, and extractor, several parts of the internal mechanism are done away with, including the mainspring and hammer, but the same form of shell is used as in the percussion system, the electric primer being simply substituted in the place of the cap.

The change in the shell for use in the electric system by the substitution of the igniter for the percussion cap is made at small cost, and as the igniter is not destroyed or displaced by repeated firing, it has been found to have practically the life of the shell.

The advantages of this system, besides that of economy, are as follows:—

1. *Safety*.—The cartridge is rendered absolutely safe by dispensing with the use of fulminate employed in the ordinary cap. This consideration is most important in single-loading arms, but for repeating arms it is vitally essential, as all danger arising from cartridges resting upon each other in the magazine is wholly prevented. The risk in transporting and handling cartridges is also done away with.

2. *Certainty and Perfection of Fire*.—Perfection in the making of the present percussion cap can only be proved by its explosion, whereas each igniter can be tested before the shell is loaded.

As the igniter can be extended any distance into the shell, the powder is lighted over a larger area, the entire charge is more completely burned, and more force to the explosion secured.

3. *Greater Accuracy in Aim*.—The mechanical force employed in pulling the trigger in existing arms is a cause of inaccuracy in aim, which by this system is wholly done away with.

4. *Non-corrosion*.—It is well known that the firing of the fulminate in the cap is injurious to the chamber and barrel by reason of its corrosive effect; this is wholly avoided by the use of electricity.

5. *Effect on the Shell.*—The life of the shell will be considerably lengthened by the avoidance of the strain caused by the expansive force of fulminate, and the necessity of re-forming the shell for repeated use will be lessened.

The continued improvements in the manufacture of sporting and military guns—the changes from the flint lock to the percussion cap, and from that to the central fire—seem to find their fitting climax in the electric system as now perfected in these inventions, which give the power to have within the weapon itself the source of ignition for many thousand rounds, and in the shell the medium for its use without any change in the external form of the weapon as at present constructed.

The generator or battery is simple, solid in construction, and conveniently placed in the butt of the gun. From actual experience as many as 15,000 ignitions have been obtained from one battery without any change of the elements, and extreme alternations of temperature seem to have no effect on its efficiency. An average of 5,000 to 7,000 is therefore considered a safe estimate of the number of shots that can be fired from an electric gun or rifle without change of battery.

The conditions of economy, perfection of fire, and safety in the use and transportation of guns and ammunition are specially called for in military weapons, and it is believed that all these benefits have been attained in these inventions.

The system has been put to very severe and exhaustive tests in the United States, principally by Captain S. A. Day, of the United States Army, who is well known as an authority on the subject of army weapons, and has had much experience in their use and knowledge of their construction.

The following reports from him are of interest. Some of his remarks refer more especially to sporting guns, but with few exceptions they are as applicable to rifles as to fowling-pieces.

REPORT OF CAPTAIN S. A. DAY, U.S.A.

*Port Hamilton, New York Harbour,
September 8th, 1884.*

When the system of ignition for small arms under consideration was put in my hands for test June 23rd last, I was able to state to you at once some of the obvious advantages of substituting electric fire for percussion, provided it could be accomplished in a manner to meet every practical requirement.

To be an important and prevailing success, however, it would need to give these advantages in the present highly perfect sporting and offensive arm without failing in any requirement for their best use. It seems entirely probable that the present generation at least will continue, not only to fire with the accustomed trigger, but will adhere to the special pattern of arm which the individual finds reason to prefer.

The obvious advantages of electric discharge may be stated in the probable order of their importance, viz. :—

1st. The absolute safety of cartridges containing only a metallic igniter in lieu of the fulminate for percussion.

This in itself might give ample reason for the change of a system; it eliminates the fear of danger in magazine-guns, otherwise growing so rapidly in favour, and it

abolishes the risk attending the loading, transporting, and handling of ammunition containing fulminate.

2nd. It is indisputable that the power of igniting charges of long proportions at any desired point along the central line instead of the base, as with percussion primers (or even at the wad as in the needle gun), gives the facility to burn the entire charge, and under better conditions of using the expansive force. The exact point of ignition for best results should vary with dimensions and form of charge; but the power to determine at will the point at which ignition shall take place, and vary it, is given by this method. With the uniform precision of an electric point, an exactitude of performance, and an economy in producing given results, are secured, not heretofore possible, with any percussion fire.

3rd. Electricity can dispense with the disturbance of aim, incident to the necessary mechanical force in use of hammer and heavy springs to explode fulminating primers or caps. This source of inconvenience has not been duly considered, as there has seemed no way of avoidance, but it will be thoroughly appreciated when compared with a more perfect substitute.

The mode of electric fire submitted to me by you consisted of an electric igniter or primer of any desired appropriate length inserted in an ordinary metallic base shell to form the electric cartridge for breech-loaders.

Also a current pattern of breech-loading gun with a small generator concealed in the stock, and firing device replacing hammer and springs, and responding to the trigger, necessitating no change in the exterior form or apparent action of the gun.

For more than two months my critical attention has been given to the principles and practice of the methods in the gun with its ammunition. I have found no objection to raise to its entire practicability—the work is better done than by percussion locks, and the advantages appear.

It would be unwise, in scientific progress, to say what can or cannot be done in the future, but I can say that the limits of simplicity seemed to have been reached in the use of electricity in this invention. Fewer parts (and consequently less expense or element of uncertainty) could hardly seem possible, and I am not aware that the results can be satisfactorily produced outside of the methods of this invention.

With proper knowledge and mechanical skill I see no reason why the method cannot be introduced into any of the improved small arms in use (above the size of a pistol), and with excess of room from the elimination of cap-striking machinery. Having a familiarity with most of the approved arms, I know of none to which I believe I could not myself introduce this electric method without interfering with the other characteristics of the arm.

I have made the electric primers for my shells (thus forming the cartridge of this invention), and they do their work perfectly, with this additional convenience, that the primers have not been destroyed or displaced by repeated firing. Therefore there is no de-capping or re-capping necessary for brass shells. I have kept them in continuous use without change, and the primer seems to have the life of the shell.

Another marked convenience attaching to this electric ammunition is that the perfection of the primer can be tested before loading the shell, in a second of time; whereas with percussion primers to test is to explode, and an imperfect construction is only known by the loss of a shot.

The electric generator or battery is of simple solid construction in one small substantial case, readily inspected or removed at will through the heel plate. Several exterior forms were furnished, and I have given my opinion as to the most desirable; but none of them occupied sufficient space to weaken the stock of the gun.

I see no occasion for the disturbance of the functions of the generator by any proper use of arms, or other than by accident, that might otherwise disable a gun or fracture its stock.

I have used several of these generators, and I see no scientific reason to doubt the statement of electricians that from 5,000 to 20,000 ignitions, depending on the construction, can be made without replacing the elements, and that long periods of

disuse require no more care or expertness than is necessary in care of an ordinary percussion lock.

The sum of my criticisms is, that this substitution of electrical discharge stands the requirements, and therefore gives the advantages over percussion first named.

It remains to apply the skill in the adaptation of this method to other standard patterns of small arms to enable this ammunition to be fired by their triggers, and the world at large will have the opportunity of experiencing the superiority over percussion.

I came to the subject with the conviction that electric fire would at some time supersede the clumsier mechanical modes ; but nothing before presented, here or in Europe, has attracted attention as even claiming to fill what I consider the absolute requirements of use with modern arms.

Now I find myself, with permission, adopting this use in my own favourite guns. I hope, as time will permit, to give you some comparative records.

I remain, gentlemen, with respect, yours, &c.,

(Signed) S. A. DAY, U.S.A.

MARTINI RIFLE (ELECTRIC).

In another report dated Fort Hamilton, New York Harbour, he says :—

June 8th, 1885.

I have just finished the test of the Martini Military Rifle submitted, and have the honour to make the following report :—

The gun worked well in every respect.

One primer seems to have been destroyed at the tenth fire, all of the others, though repeatedly fired, are still in working order.

The double in the pull on the trigger in this gun I regard as a particularly good feature, allowing, as it does, for the most careful correction in sighting at the last instant.

The battery, as well as the other parts of the gun, worked well, and on inspection after the trial is found to be in perfect order.

The charges used were 80 grains powder and 480 of lead in the bottle-necked shells. There was no escape of gas around the primers and very little at the mouth of the shells.

The recoil and general shock of the piece seems to be less when fired by electricity, using the same charges, than when percussion is used, and the results were more uniform.

With uniform primers I think the gun can now be safely submitted to a field test.

Very respectfully and truly yours,

(Signed) S. A. DAY, U.S.A.

The following memorandum of a trial of the electric fire in double-barrelled guns made last summer may be of interest as showing the result of continuous firing on the electric primers in brass shells.

MEMORANDUM OF TRIAL AT THE PARKER BROTHERS ARMS MANUFACTORY.

Meriden, Connecticut,

July 17th, 1885.

(To be an exhaustive test by Gun Manufacturers.)

Guns taken, Colts double-barrelled and Harrington double-barrelled. Batteries, one that had been four months in gun, one two months, and one new. The oldest had already made 5,000 ignitions, and the second, say 2,000. The entire testing was made with the older batteries.

Present, the Superintendent and Assistant of Manufactory, the Assembler, and the Chief Salesman, who is a noted wing-shot. All were critical experts, and all participated in the testing, which was entirely in their hands and not limited as to its character.

The examination lasted some five hours, the barrels being at times cooled in water to save time.

The firing was at flying objects, and some of the cartridges were dipped in oil, and otherwise the treatment was severe and unsparing.

The guns never failed or flinched in their work, excepting that one primer point failed. This fault was definitely located to the primer (and not the gun or battery), and was not considered by them as noteworthy, in consideration that the manufacture is new and not systematized, or in practised hands.

Captain Day also sends the following :—

REPORT OF COMMENCEMENT OF COMPARATIVE TESTS OF ELECTRIC FIRE WITH RIFLES, ELECTRICITY AND PERCUSSION BEING ALTERNATELY USED THROUGH SAME BARREL, IN RIFLE CONSTRUCTED TO FIRE WITH EITHER.

*Fort Hamilton, New York Harbour,
July 21st, 1885.*

I enclose two targets made yesterday with the Hotchkiss Military (Bolt) Rifle, and which tell their own story as far as it goes.

They were made with the same gun, elevation of sight, hold (as near as could be) ammunition, &c.

The bolts being exchanged for alternate shots, so that the conditions of weather, wind, fouling of the gun, &c., should be as near the same as practicable.

The better score made by the electric fire I attribute somewhat to the pleasanter and, of course, better pull of the trigger in the electric bolt, and which we know is a big thing in fine shooting.

But the points of importance are the evenness of the elevation kept in the electric as compared with the percussion, and as shown in the graphic illustration by parallel lines on the margin, and the mean height of the shots on the target, and which proves as far as it goes a flatter trajectory, or greater velocity, due I think to the central ignition by electricity.

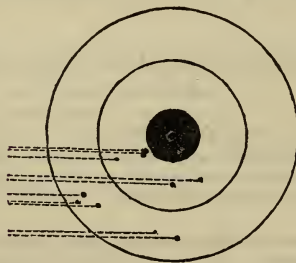
This too was accompanied by much less recoil of the piece and a softer report, a total of good results that I hardly hoped for.

It is sufficient I know that my name is signed to the transcript of the targets, but the experiments were made in the presence of, and under the careful observation of another Officer of my regiment, Major Brinckle.

Yours respectfully and truly,
(Signed) S. A. DAY, U.S.A.

*At Fort Hamilton, N.Y. Harbour,
July 20th, 1885.*

*Gun—Hotchkiss, Milt. Cal. 45. Percussion.
Am.—70 grs. powder, 500 lead.
Elevation—275 yards.
Distance—300 yards.*

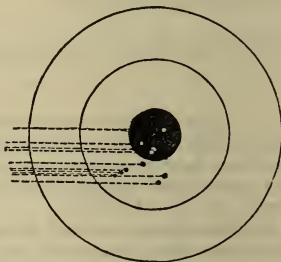


Score—4, 4, 3, 3, 3, 4, 4, 3, 3, 4. Total, 35.
PERCUSSION FIRE.

S. A. DAY, U.S.A.

*At Fort Hamilton, N.Y. Harbour,
July 20th, 1885.*

*Gun—Hotchkiss, Milt. Cal. 45. Electric Fire.
Am.—70 grs. powder, 500 lead.
Elevation—275 yards.
Distance—300 yards.*



Score—5, 4, 4, 5, 4, 5, 4, 4, 4, 4. Total, 44.
ELECTRIC FIRE.

S. A. DAY, U.S.A.

Major ARMSTRONG : I should like to ask one question. Am I to understand from the diagram that the yellow pin marked A in the upper diagram is supposed to carry the ignition into the cartridge itself?

Mr. SEYTON pointed out the cartridge and the igniter.

Major ARMSTRONG : Is that the exact length?

Mr. SEYTON : You cannot make it any length.

Major ARMSTRONG : Because it seems to me that that is one of its most important features, that the ignition can be taken very much further forward.

Mr. SEYTON : It can be taken any length you like.

Major ARMSTRONG : I think there is no question about it, the ignition is better, and the result is altogether better if the ignition takes place at the base even of the bullet.

Mr. SEYTON : That is Captain Day's opinion, and that is the opinion of most of the experts I have consulted.

Major ARMSTRONG : That seems to be one of the most important features.

Captain CURTIS : There is not the slightest doubt that a great deal of powder is usually blown out without igniting, but if the powder is ignited at the base of the bullet this cannot happen. When they introduced the prism powder in big guns I believe much of it was blown out unburnt. This often occurred in saluting, greatly to the danger of passers by.

Mr. MORRIS : An almost identical system with this was shown in this Institution about two years ago, by Colonel Fosbery, U.C., and was the invention of Mr. Pieper, of Liège; they are practically identical.

Mr. SEYTON : I have full knowledge of what Mr. Pieper has done. It is entirely different in the form of the shell, and in the method of firing.

Mr. MORRIS : He has a battery in the butt.

Mr. SEYTON : He has no battery like this; it is on a larger scale altogether. The butt is very much more hollow. The advantage of this style of battery is that it takes such a very small space in the gun.

Mr. MORRIS : I have seen one not bigger than a watch, the whole thing.

Mr. SEYTON : The question is how long that would last.

Mr. MORRIS : I have seen about 8,000 shots out of it.

Admiral BOYS : What is the expense of this arrangement, fitting the battery to the gun?

Mr. SEYTON : As to the cost of the battery, I estimate it would be from 8s. to 9s.

Admiral BOYS : To each gun?

Mr. SEYTON : To each gun. If they were made in quantities they would not cost more than 5s. or 6s.

Admiral BOYS : There is a fitting in the cap of the cartridge?

Mr. SEYTON : That is the igniter. I think we can make igniters with paper shells for about 4s. to 4s. 6d. a thousand. A better class of igniters for brass shells that would last as long as the shells, the shell being re-loaded so many times, would cost more than double. They are better made, and of better material; they would cost very nearly 10s. a thousand, or perhaps 11s.; against that you must put that they last so much longer. An igniter is not thrown away with every shot, as it is with the percussion cap.

Captain BURGESS : How long does a shell last?

Mr. SEYTON : These good solid brass shells will last 50 shots.

Mr. MORRIS : Do you know anything of the keeping powers of the ammunition, because military ammunition has to be kept in store from five to six years.

Mr. SEYTON : I could not say, because the invention is only about a year or fifteen months old.

Mr. MORRIS : That is the very trouble other inventors have had.

Mr. SEYTON : I have no doubt it would last. I have no reason to doubt that both battery, cartridges, shells, and igniter would be easy to store, and keep in as good condition as any other ammunition.

The CHAIRMAN : It appears to me the principal point in connection with this gun is the weight and dimensions of the battery. Of course what will fire a small gun will fire a heavy gun. If we can fire a gun with a small battery like that and continuously, the battery must be a very valuable one. The battery is remarkably

cheap at the price named. We do not know much of its lasting power, but if it has good lasting powers, it will be a very valuable battery. I am sure you will all allow me to return our thanks to Mr. Seyton for his interesting description of this invention.

DESCRIPTION OF PLATE.

(From S. Russell's Patent.)

Fig. 1 of the accompanying drawings is a vertical longitudinal section of the breech of a double-barrelled shot-gun constructed according to my invention, the plane of the section passing through the axis of one of the barrels and through the centre of the stock. Fig. 2 is a longitudinal section cut along the line 2 2 in Fig. 1, and looking in the direction of the arrow 2 therein. Fig. 3 is a section of the preferred form of electric cartridge to be used with my gun appended to a diagram showing the electric circuit.

The cartridge A (shown in Fig. 3) is the same as that described and claimed in another application for patent executed by me this day, to be filed simultaneously herewith. Its distinguishing feature is that the metallic base of the shell forms one terminal of the incandescing conductor, and the other terminal thereof is centrally arranged and insulated from the base.

Let *a* designate the metallic shell, and *b* the central conductor, which is a metal pin or rod, and is inclosed in a tubular insulating sheath, *c*. At its front end is connected the incandescing conductor *d*, which consists of a short piece of fine platinum wire, and the other end of this conductor is joined to a conductor, *e*, which consists of a strip of copper, which passes along the outside of the sheath *c* and joins the metallic base *a*. The base of the cartridge comes against the breech-block B, which is connected through a wire, *f*, with one pole of the battery C, and the other pole of this battery is connected by a wire, *g*, to a firing pin or bolt, D, of metal. The battery is usually placed in a mortise in the butt-end of the stock, the wires *f g* passing through a hole or holes therein to the breech. When it is desired to fire the cartridge, this firing-pin is pressed forward until it touches and makes electrical contact with the pin *b* in the cartridge, whereupon the circuit is closed, and the current in passing through the platinum conductor, heats it to incandescence and ignites the powder.

The gun is entirely hammerless, resembling externally the so-called "hammerless guns" or internal hammer-guns, and being constructed internally in some respects similarly thereto.

Let E E designate the barrels, F the stock, and G the breech. The gun is a breech-loader, and is provided with the usual fastening for holding the barrels to the breech when turned up, consisting of hooks, *h h*, on the barrels, engaging a sliding bolt or frame, H, which is operated to release the hooks by the usual unlocking-lever, I, on top of the breech. The bolt H is pressed forward by a spring, J, on a rod, *j*, as usual. The breech-block B is solid with the breech, and is formed with two conical holes, in which are fitted tubular conical plugs K K, of insulating material, which form bearings for the firing-pins D D. The point of the cone is turned towards the front, so that but a small orifice is made in the face of the breech-block. Each plug K is held in place by a ring-shaped frame, *k*, of metal, which takes against a shoulder on the plug, and is forced towards the front by two screws, *i i*, Fig. 1. Back of this ring *k* the plug K is reduced in diameter, and over it is placed a helical spring, L, which is reinforced against a shoulder, *l*, on the plug, and presses backwardly against the head of the firing-pin D. The rear surface of this head is covered with an insulation, *m*.

T T are the triggers, or, more correctly, firing-levers. Externally these are the same as on an ordinary gun, but internally each is formed with two arms, M and N. The arms M M extend up to the respective firing-pins D D, where their ends rest against the insulating-caps *m m*. When either trigger is pulled, the arm M pushes its

RUSSELL'S ELECTRIC GUN AND AMMUNITION.

FIG. 4.

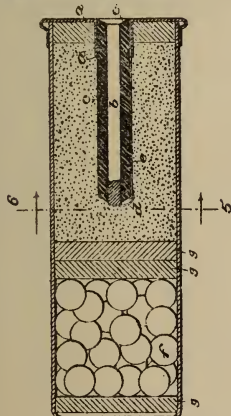


FIG. 5.



FIG. 6.



FIG. 1.

FIG. 3.

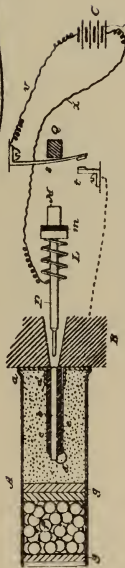
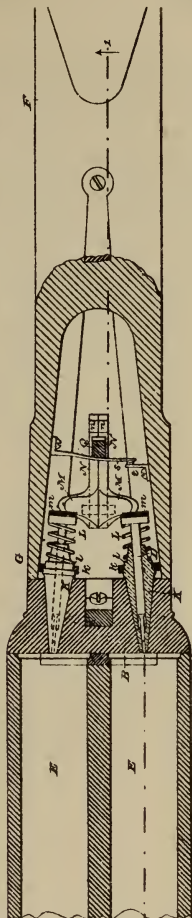


FIG. 2.



firing-pin forward against the resistance of the spring L until the point of the pin touches the centre of the cartridge and fires it. The springs L L serve as trigger-springs in addition to their function in retracting the firing-pins, and should have sufficient stiffness to give the requisite "pull" to the trigger. The arms N N of the two triggers extend rearwardly, and their ends are turned up, as shown at *n* in Fig. 1. Underneath the top plate of the breech is arranged a slide, P, which has a limited movement forward and backward. On this slide is an arm, Q, which projects downwardly to the ends *n* of the arms N N. When the slide P is moved forward, as shown, the end of Q does not interfere with the ends *n n*, and the triggers may be pulled as denoted by dotted lines in Fig. 1; but when the slide P is moved to the rear, the end of the arm Q comes directly over the ends *n n* of both arms N N, and the triggers are locked and cannot be pulled. This is the "safety" lock of the gun. It is operated by means of a roughened button, R, on the top of the stock, and when moved either forward or back it is held there by the spring *p* acting against a V-shaped projection, *q*, on the slide. When the unlocking-lever I is turned to permit the barrels to be broken down, the backward movement of the bolt H pushes back the slide P, and so sets the gun to "safety." This is done by the pin *j*, which moves with the bolt H, striking and pushing back a shoulder, *r*, on the slide P. After being loaded the gun cannot be fired until the button R has been pushed forward. The manipulation of the gun is thus the same as of the well-known hammerless gun before referred to.

In addition to the mechanical safety-lock to keep the trigger from being pulled, I provide as an additional safeguard that whenever the slide P is drawn back to "safety" the electric circuit shall be broken at some intermediate point, in addition to the break between the firing-pin and the cartridge. In this manner I entirely isolate the battery from both terminals of the cartridge, except when the gun is ready to be fired. On the inside of the stock is fixed a contact-stop, *t*, Figs. 2 and 3, and a spring, *s*, is attached to the opposite side, passes in front of the arm Q, and terminates with a contact-pin facing the stop *t*, as shown in Fig. 3. When the slide P is moved back, this spring does not touch the stop *t*, and the circuit is broken between them, as shown in Fig. 3; but when the slide is pushed forward the arm Q presses the spring against the stop, as shown in Fig. 2. The spring and stop form part of the wire *f*, as shown (in preference to the wire *g*), in order to break the connection between the base of the cartridge and battery.

Friday, April 2, 1886.

REAR-ADMIRAL LINDESAY BRINE, Member of Council, in the
Chair.

ON THE OFFENSIVE AND DEFENSIVE POWERS OF MERCHANT STEAMERS.

By Lieutenant WILLIAM C. CRUTCHLEY, R.N.R.

If an excuse were wanting on my part for venturing on this subject, I should plead a paper read at this Institution on February 9th, 1883, by Sir Nathaniel Barnaby, K.C.B., in which he states that "The power of waging war upon the seas depends firstly on the quality and extent of the mercantile marine in ships and men, provided that the national tie in both is real and firm."

Assuming this statement to be correct, there would be little doubt as to our maritime superiority, but on the other hand there are a vast number of competent authorities who maintain that our enormous fleet of merchantmen is our most vulnerable point, and that thus in our strength lies our greatest weakness. As with most arguments there is a great deal to be said for both sides of the question, but I shall endeavour, though in a very imperfect manner, to show that a great number of our faster vessels are an absolute source of strength, provided that care be taken in peace-time to place them in a condition to be serviceable on the sudden outbreak of war.

It is no new scheme that I advocate, it is simply a return to the old fashion of arming merchantmen to enable them to take care of themselves, but with this difference, that fifty years ago, the ship-owners found the arms as freights were good and arms inexpensive; these latter conditions now having been reversed, it would devolve upon the Government to supply weapons if merchantmen are to be armed for the protection of their own commerce. As lately as 1863, I am under the impression the Admiralty were disposed to supply armaments to trading vessels, but the custom seems to have dropped into disuse during the transition period from sail to steam.

It will, I think, be admitted that the conditions of naval warfare have essentially changed, having regard to the modern steamer and the old sailing vessel. In our last great naval war, men of war or privateers were usually much faster than merchantmen, and it was a matter of almost certainty that a fast and well-found frigate could overhaul anything afloat. This condition of things has been entirely changed, and there are very few men-of-war afloat that in war-time could afford the time and coal expenditure necessary to catch a

14-knot merchant steamer. I will put the case this way: Suppose a steamer sights a man-of-war, say 10 miles off, and has no desire to be interviewed—he (the merchant vessel) is of course making his passage as quickly as he can—the man-of-war, on the contrary, is cruising under easy steam, say 10 knots, or equal to that speed, which is a very fair allowance; by the time the man-of-war was under a full head of steam, even with all the advantages of forced draft, the merchantman would, if wide awake, have increased the distance between them to 13 or 14 miles, and the man-of-war would have to steam very fast to overtake his chase or get within effective gun-shot before dark, when a change of course or lots of things might render capture very doubtful. I am of course aware that a fast torpedo-boat might play an important part in such a chase as the foregoing, but it is at least problematical whether top speed, say 18 or 20 knots, could be maintained by a small vessel in a sea-way.

I put this case because I do not consider the risk of capture of a fast merchant steamer by a man-of-war very great. In war-time as at any other, a man-of-war would be recognized a great distance off by a number of things, no matter how he might try to disguise himself, and I need not say that in war-time he would be most piously allowed the entire visual horizon to himself, no matter what his nationality. In saying this, be it understood, I believe I am stating what would be the procedure of every merchant steamer that had heels to run with. But the foregoing remarks do not apply to fast armed vessels built for merchantmen that have been turned out to capture and do damage to their own kind; they would probably be approached with less caution, as it would not do to run from everything, and with far more disastrous effects.

A great portion of the carrying trade of this country is done by 10-knot vessels, and it is certain that the only effective way of securing these from capture would be by placing them in convoy, and protecting them by cruisers and torpedo-boats. I do not propose to discuss the question of these vessels at all, their protection has doubtless been well threshed out long ago. My remarks are now intended to apply solely to the larger ocean mail steamers. I need not particularize, and in fact I must try to keep clear of everyone's toes, or I am afraid I shall make a warm corner for myself; but I shall take as my type of vessel the one I now command: by this I mean that the arrangements I should make for her would doubtless require modification for another class of ship, but the principle would remain precisely the same. She is employed in the New Zealand mail service, and is one of a fleet of five similar vessels.

Leaving New Zealand last May for England, the greatest uncertainty prevailed as to whether it was to be peace or war with Russia. My ship was first taken up as a cruiser, and then, at the solicitation of her owners, dropped again, but the fact remained that we left New Zealand for England full of cargo and passengers, utterly defenceless, and for aught we knew war might have been declared the next day. Rio Janeiro was my first port of call, and I was very glad when I got there, so were my passengers, as I had nearly suffocated them in hot

weather when night came on by having dead-lights closed to keep the light in and hide the appearance of a floating town that electric lights fore and aft presented. I had carefully avoided all ships, and I presume I was not the only man at sea in a state of similar anxiety. The question kept constantly arising in my mind, "Why am I sent to sea in this defenceless state, entirely at the mercy of every mosquito of a ship that has the speed to bring say only one machine-gun within range?"

That was what the case amounted to: utterly defenceless, ship, cargo, and specie to the value of a quarter of a million at the mercy of anything fast enough to come alongside with the meanest armament possible, and we carrying a crew of one hundred and forty men, including three Officers of the Naval Reserve, and about twenty-five trained seamen.

Now, I presume, if England were to go to war with a foreign Power, we may fairly conclude that that Power, whichever it was, would be fairly ready to begin when war was declared, and that lines of ships coming from distant ports would be watched by the enemy's cruisers as closely as our men-of-war would let them, in the hopes of falling in with a big prize that might be useful, both as far as plunder in specie is concerned, and also as a means of committing further depredations on our own ships and commerce. The story of the wolf in sheep's clothing will explain the sequel. A vessel of English build and rig, such as the one I am speaking of, would, if she were able to intercept one or two coal-laden sailing ships, do an amount of damage that would compare very favourably with the "Alabama's" captures; she would approach our vessels unsuspected and at leisure, and destroy or capture them in detail.

There are many corners on this route—New Zealand to England *viâ* Cape Horn—where an enemy might establish a coaling station and depôt for arms and men, and where for a month or so they would be unmolested and at liberty to fit out their ships; for instance, the inlets of Tierra del Fuego and South Georgia, to say nothing of the numberless islands, out of the way places in the Pacific. I am well aware that our system of ocean surveillance is very perfect, but it is not reasonable to expect that we can concentrate an adequate force at a week's notice in any corner of the world, and a ship able to steam 350 miles a day for two months without coaling could shift her quarters pretty rapidly.

Now I think that were these vessels supplied with a moderate armament, and kept so with their present crews, they would be able to give a fair account of themselves to any of the scratch pack that at the first outbreak of a war would be most likely to attempt their capture and subsequent conversion, for if ever we are called upon to fight for our maritime supremacy, our men-of-war will be fully employed looking after the battle-ships of the enemy, and their fast armed merchantmen will for some time at least be able to harass our commerce seriously.

I will now proceed to mention the means that would to a certain extent obviate this evil, and in so doing I must not be understood as

prescribing a quack nostrum that will suit all cases, but my remarks apply, as I said before, to the vessel I command, and I know there are many such afloat to which they are equally suitable.

In doing so I shall bear in mind that merchant vessels are intended to carry freight and passengers, not to fight as long as they can run, that shipowners would have to look on any scheme such as this with a favourable eye to insure its success, but also to bear in mind with this latter proviso, that a possible moderation of a war premium might have a decided weight in turning the scale.

Another point is expense, and although last, it is not the least; but I think it may be found that by the expenditure of stores now idle in our arsenals and dockyards, a fair number of our long voyage steamers may be placed in a condition that could not be described as at the mercy of anyone. I speak more freely from the fact that I am left with free hands by the Company I now serve, they being willing to go to any reasonable trouble and expense to further any scheme of armament that might be decided on for their ships.

I take as my typical ship the "Kaikoura," of about 8,400 tons displacement at her load draft, 420 feet long, and 46 feet beam, built of steel, three steel decks, and bridge and poop superstructures, well subdivided by watertight bulkheads, and on the Admiralty list as complying with their requirements for an armed cruiser, boilers below the water-line, and engines are capable with little trouble of being protected with coal below the main deck to the extent of 12 feet in thickness on either side. The cylinder tops rise 6 feet above the level of the main deck, and these can also be protected easily by the same thickness of coal, or if bound from New Zealand, by closely dumped wool bales. This latter article has not been tried as a means of resisting shot that I am aware of, but as it assumes the hardness and solidity of wood or india-rubber under the enormous pressure to which it is subjected, I am under the impression that it would answer admirably, and yet not be liable to fire or blaze in such a manner as to defy an ordinary fire-hose. I mention wool bales because it might not be advisable to immerse a ship as deeply as full holds and a coal belt also would do.

This thickness of defensive material would, I take it, be beyond the power of a machine-gun to penetrate, except perhaps at very close quarters, and referring to the experiments of 1878, as per Gunnery Manual, page 258, I find that 12 feet of coal would afford protection from the fire of a $4\frac{1}{2}$ -ton gun, with a 24-lb. charge, at a range of 100 yards. I do not think that any merchant vessel could resist successfully anything larger.

If it were necessary, say if war were declared, to make further defensive preparations, steering gear might be arranged for various covered places, even to steer from under cover of the forecastle, as the wheel-house would be most assuredly riddled; boats could also be kept under cover of the bridge superstructure, and hoisted in or out with small derricks at either end. I do not enter further on these details, as being rather beyond the scope of this paper, my object being to put the ship in a condition to do her ordinary work, and yet

to be capable of easy transformation to a condition of tolerable defence.

I learned recently from the Officer who fitted out the steamship "Lusitania," that that vessel was armed with eight 64- and 40-prs., but this number would, I think, be too many by one-half for ordinary purposes. Four 40-lb. breech-loaders would be a fair armament to be constantly carried. These guns, mounted on wooden slides, with an arrangement of pivoting bolts, could be carried fore and aft abaft the gangways, clear of everything at sea and in harbour, and in no way interfere with the ordinary working of the ship. If it were needful to put the ship in a state of defence, it would be little trouble to mount one on the forecastle head, and another right aft under the poop superstructure, the remaining two could be fitted to traverse to either side, as they were required. I do not, however, think that the truck carriages on which they are at present mounted are at all suitable for merchant steamers, in fact very few decks could stand the handspike work necessary for training without soon showing signs of wear and tear.

I believe I am correct when I say there are numbers of these guns in store in various parts of the world. I know that I took out a quantity some three years ago to a naval station, and it is reasonable to suppose that there are similar weapons lying idle in England, which need not be deteriorated or spoiled by being placed on board the vessels now, on which they would be used in case of need, and with this advantage, that the crews of the vessel would get accustomed to them, even the men that were not in the Reserve. The same remarks would apply also to a supply of small-arms.

Of course I am aware that many other things would be required to constitute an efficient cruiser, but the arms I have mentioned would enable her to defend herself against a chance antagonist on the sudden outbreak of war. In the event of her being taken up by the Government, it would be a distinct advantage to find her to a certain extent already fit for her work, with magazines, &c., fitted, and, not least, with her failings discovered as a gun-carrying vessel. I have said nothing about machine-guns, they are expensive, are not bulky, and are susceptible of being easily fitted to a vessel in a hurry, and their comparatively delicate mechanism might require more care and attention than it would or might be always possible to give them in a vessel not carrying a large fighting crew.

Thus far I have spoken only of the equipment necessary to enable a merchant steamer of the first class to travel from port to port in unsettled times with any pretension to security. I wish that my knowledge of naval history would help me with some parallel case for a slow unarmoured man-of-war attacked by two powerful armed merchant steamers. No one knows better than a gunner that every shot that is fired does not hit. I have known a straight stem steamer start the entire side of a solid dock entrance with no damage to herself whatever, and unless her torpedo-boats helped the man-of-war she would be undoubtedly rammed and sunk. I touch very lightly on this subject, as there are so many things which have to be taken into

consideration. And again, the offensive is not so much my subject as to urge the adoption of measures which may mean in a great measure an important factor in considering the supplies of the country in war-time. It just occurs to me that Nelson's great want was frigates; had he lived now he could have had as many look-out ships for establishing communication as his heart could wish for.

With regard now to the manning of these vessels, no one knows better than a merchantman the immeasurable distance there is even between the smartest of mail steamers and a man-of-war. And although I have often heard it used as a fault or term of reproach, when applied to the master of a merchantman, "He tries to copy the Navy," I fail to see where the harm comes in. If a man chooses to make the Navy his standard of efficiency, he has chosen a very high one, and he may rest comfortably assured that he will be hopelessly beaten in his struggle to attain to it, but although beaten, he will not feel beaten, but will have the satisfaction of knowing that his efforts have been expended in the direction of bettering his service generally. Every man cannot have the good fortune to sail under the pennant, but nevertheless I think the greater proportion of the mercantile marine would feel both pleased and honoured if they thought they had a chance, however remote, of serving their Queen and country.

Now Jack has an old proverb which says, "Different ships, different long splices," and that applies very closely to the mercantile marine of this or any other country. If you want them to make a splice, metaphorically, you must give them a splice to make that they are accustomed to, and let them do it in the manner that suits them best, or in other words it may be put that Merchant Jack sings out on a rope, when he is pulling, because he says it helps him, and Navy Jack does not, because there are generally men enough for a stamp and go, and he is not permitted to make a noise. I say this, because if mail steamers were armed to-morrow, it would not be possible to carry out the routine in the manner Naval Officers have always seen it done, but my experience is that the crew of a mail steamer are susceptible of a very large amount of discipline. Treated with a firm but kind hand, fed well, and worked judiciously, I really believe that, strange as it may appear, Jack does not dislike his ship, and a moderate amount of coercion.

This conviction has been forced upon me latterly, for as by the present Merchant Shipping Act there is hardly such an offence as desertion, as the sailor can give two days' notice and leave his ship, I have found my crew remain almost intact, in spite of the very much higher wages they could have got abroad, and I know that a crew will remain a long time in a ship if they are permitted to do so.

In all my remarks concerning mail steamers, I am assuming that they are commanded by Officers of the Royal Naval Reserve, and that they are in possession of the warrant authorizing them to wear the blue ensign of Her Majesty's Fleet. Few Officers in Her Majesty's Fleet know the amount of self-denial that is necessary on the part of a Reserve Officer to fulfil his drill engagements. For the most part in constant employment, his only chance when he gets a fortnight's

leave or so, is to take lodgings fairly close to some drill ship, and devote the hours of drill to the endeavour to pick up as much gunnery and useful knowledge as he can persuade people to teach him; that is, of course, if his heart is in his work. The Sub-Lieutenants who do no drill are, I am glad to see, growing into a small minority on the active list, but every leave that I have had since joining the Reserve has been taken up by drill, so that I quite recognize the difficulty.

There is this to be said, that when an Officer has done three months' drill, say in the "President," he should have a fair practical knowledge of gunnery, and would not learn much more in that ship, unless he acquired a greater facility in handling men at battalion drill, which for an Officer in charge of a merchant steamer is quite unnecessary, and nearly useless; on the other hand, *if* Officers, on attaining a certain standard of efficiency, were permitted to take a short course of gunnery on board the "Excellent," it would be a great boon to the younger Officers especially, who, by making an effort, might possibly be able to avail themselves of the chance. It would do a great deal of good in many ways, for my experience is that even the short training they undergo now makes better men of them. I say nothing of the advantage it would be to the merchant service generally if Sub-Lieutenants, newly made, were permitted to go for a cruise with the Channel Squadron. It was quite a step in the right direction when some Officers were allowed to sail in the Evolutionary Squadron last year. It was only by a correspondence with the Admiral Superintendent of Naval Reserves some years ago that I succeeded in getting the Gunnery Manual supplied to Officers who had passed their test examination. It appeared necessary to point out that some Officers wished perhaps to know a little more of gunnery than was to be acquired by mere drill, and this privilege is capable of extension to many books not to be obtained by purchase, but which would be studied attentively by men to whom possibly the knowledge might prove some day of the utmost value. There is one way by which the number of Officers in the Reserve might be largely increased, if it were ever required to do so, and I am speaking now more particularly of Engineer Officers, for if we should ever again engage in a big naval war, there would not be too many combatant Officers left at the finish.

If it were once understood that on being called out on a national emergency it would be optional on their part to retain their position in the Navy at the close of the war, the matter would be settled, but it would not give a man much heart to know that he had lost his berth at the beginning of a war, and at the end was to be cast adrift to begin again, very possibly at the bottom of a strange service.

I have often been asked what advantage it is to hold a commission in the Reserve, and I think that all I have been able to say up to the present time is, "Why, your ship can wear a blue ensign under certain conditions;" but really I look to it as a means to an end, which is summed up in a few words. *I do not see there is any reason why an Officer commanding a mail steamer should not be able to sail his ship in the piping times of peace, and fight her as well as another man if*

it came to war. It has been advanced on more than one occasion that were merchant vessels armed and then captured by an enemy, the crew would be liable to treatment as though they were privateers. I cannot see that that argument holds in this case. A steamer is authorized by Admiralty warrant to wear "the blue ensign of Her Majesty's fleet," so runs the wording of the warrant. It follows therefore that a vessel carrying by right the flag of Her Majesty's fleet could not possibly be a privateer. It might as well be said that the endeavour to ram an enemy attempting his capture, by an unarmed ship, constituted him a privateer.

I am aware that there would be some difficulty at first in getting enough Officers together in any one ship. I am particularly fortunate, as I happen to number two well-trained Sub-Lieutenants amongst mine, but that would be a matter of easy adjustment; for instance, it might be arranged that selected Officers from a ship wearing the blue ensign should be permitted to receive instruction, without pay, on board a drill ship with a view to qualifying for a commission. This, with the drill they would get on board their own ships would meet the requirements of the case, and be of vast service to the merchant service generally: furthermore the principle of selection of Officers will have to be adopted in future if the Reserve is to be efficiently officered; I say this because the sole promotion from midshipmen shuts out numbers of the best men.

The men of the Royal Naval Reserve are, I have no hesitation in saying, the pick of the mercantile marine, not perhaps the prime seamen of thirty years ago—steam has spoiled all that—neither are they as good as some well-trained men-of-war's men, who have been taught and brought up in a training ship from the time they were first caught, if it comes to a complicated matter of knotting and splicing; but for the ordinary duties of a seamen they do well, and have this advantage, that they are accustomed to do a lot of work with very few men, and to make the best of materials at hand.

The training also that the men have gone through has exercised a marked influence for good throughout them all. Jack is quite clever enough to see that a system of working saves trouble, and he can also appreciate the advantages of a firm and consistent discipline, and last, and not least, they are so well and fairly treated on board the drill ships, that the Reserve grows more popular with them every day.

These men have to drill four weeks every year, and as I confine my remarks to the vessel I command, I must point out that she is only in England three times a year for about a fortnight at a time, sometimes less, so that to retain the same crew under existing conditions is rather difficult, but even with these adverse circumstances I have frequently found the gaps filled up by men who have left on a preceding voyage. Similar cases might be met by a certain amount of liberty being allowed to *trained* men who had served in a vessel carrying guns upon the certificate of the Officer commanding, the drill they would undergo on board her might count for say a week of their shore drill in twelve months, and one great advantage would be that the men would be kept together, and that if the ship were

required for war purposes abroad there would be the nucleus of a crew in her. I have been informed that Naval Reserve men were not plentiful in Australia last year when war seemed imminent.

In the event of arms being supplied to a steamer it would of course be necessary to have one man whose sole duty it would be to attend to them, in fact to act as gunner; and there is this difficulty, that the British shipowner as a rule expects each man on board to take his place as a part of the money-earning machine, so that it is problematical whether he would see his way clear to paying the expenses of a gunner.

The suitable man for the berth would be a gunner's mate that had been a year or two in a drill ship. If he could be put on board by the naval authorities so much the better, the plan would have many advantages, otherwise if he were taken at the expiration of his time in the Navy, he would have to sign articles as boatswain's mate or quartermaster, the latter for preference; there would be no trouble in getting good men, as their pay in that capacity in addition to their pension would be eagerly sought for. I must again repeat that I could not enter upon this matter of expense were it not that I have the sanction of the Directors of the Company I serve. I am aware that this might not be universal, but I think I could mention others who would look upon the scheme favourably, but I have a strong feeling in favour of a gunner's mate being put on board by the naval authorities, to be attached to the Warrant Officers' mess.

I have endeavoured to deal with this matter in a strictly practical manner, without turning to outside issues, and having due regard to the numberless difficulties that always crop up at the beginning of any new scheme, I have taken it from the standpoint of the man who would have to carry the thing into practice, that is, the master of a mail steamer. The more I look at it in all its bearings, the more convinced I feel that the arming of fast merchantmen for long voyages will sooner or later become an absolute necessity. No one knows the weakness of a merchant steamer for war purposes better than myself, with its numberless steam pipes and steering gear exposed: but the knights of the Middle Ages went to battle in armour, and is it not possible that the ponderous ironclad and 100-ton gun will disappear in a similar manner to these steel-clad gentlemen, and that unarmoured ships and lighter guns will once more decide who is to have the supremacy of the seas?

In the meantime we have to grasp the matter as it stands at present, and it was only the other day that I heard Admiral Tryon tell the people of New Zealand that in spite of their recently made fortifications, their power for defence did not extend beyond the range of their guns, and that their commerce was in peril from any cruiser, unless their batteries were supplemented by a force afloat. Now the chances of any armoured vessel belonging to an enemy of Greater Britain getting to New Zealand are very small, and as there are always two of the vessels of the type I have described in New Zealand, they, if armed even in the manner I suggest, would be no mean or inconsiderable enemies for a stray unarmoured cruiser to

reckon with. Another thing also, they being five weeks in New Zealand going from one end of the islands to the other, would have ample opportunity of exercising their men at target practice, and the handling of guns at sea, a very different matter from doing so in a perfectly stationary drill ship, in fact no great number of the reserve men ever get the chance to see their sights "roll on;" there are no coast passengers carried, the crew do nothing with cargo, and there would be every chance of getting the ships into a fair state of efficiency.

I am aware that I have narrowed the limits of this paper very much, and that it is capable of far greater expansion than I have given it. I have done so purposely, as I do not wish to trespass too long on your good nature, but as we are the largest immeasurably of all maritime Powers, consequently it devolves upon us to pay a heavier insurance on our property, and to adopt measures that would be uncalled for in a smaller nation. Everything tells us, that as we are the largest, so should we be incomparably the strongest at sea; leaving aside the vexed question of ironclads our merchant steamers have no rivals under any conditions. I commenced with an excuse for venturing on the subject at all. As I have gone on the apparent necessity for an excuse has disappeared, and in its place remains a feeling of regret for the inefficient and imperfect manner in which the subject has been handled. I can only hope that these few words of mine may have the effect of rousing into action some powerful pen that may do the subject justice, and cause it to be ascertained, whether numbers of our finest ships are to be placed, say but for a month, at the mercy of every so-called "Alabama." Even supposing that one or two armed merchantmen were sunk, they would have inflicted some proportionate amount of damage on their conqueror, and to disable even one hostile ship would mean to us far more than the loss, say, of six of our own. Whether my remarks will be favourably received I know not, but I am not aware that the matter has been brought before this Institution previously from a master mariner's point of view, and in so doing I have endeavoured to pay a small instalment of the debt that every man is said to owe to his profession.

The CHAIRMAN: Lieutenant Crutchley has dwelt upon many points of very great interest with respect to the arming of merchant ships, and also with respect to their crews, and the manner in which they are to be officered in time of war. I trust that several of the Officers present will take part in the discussion.

Admiral Sir ERASMUS OMMANNEY: Lieutenant Crutchley has dealt with this subject from a really seamanlike point of view, and on the whole I think that his suggestions are very good, and worthy of the best consideration. I should like to ask, with regard to the manning question, how far Lieutenant Crutchley's Directors would be prepared from a commercial point of view to increase the crews of their ships? I think the suggestion to have a gunner's mate on board the ship, provided that you do carry heavy guns, would be a very admirable one. I should like to know whether your ship is one of those in which the structure meets the requirements of the Admiralty for offensive and defensive purposes, and whether, in your opinion, the ship which you command is strong enough to be classed as an armed passenger ship?

Admiral NOWELL SALMON: I only returned to England this forenoon, and on my arrival I found a telegram asking me to be present on this occasion. I am very happy to do so, having made Captain Crutchley's acquaintance at the Cape of Good Hope some time ago, when he was in command of one of the mail steamers. I may say Captain Crutchley was one of those members of the Naval Reserve who met my advances towards them in a proper spirit. There were very few instances, I am happy to say, in which they were not so met. I think that such *rapprochement*, if I may be permitted to use the word, is very necessary to both services, both to the Royal Navy and to the Royal Naval Reserve. Unfortunately, as I say, I did not return to England till this forenoon, and I had not read this paper before coming here. When I first took it up I was under the impression that it was on the subject of arming merchant ships to do the duty of men-of-war. I find, however, it is for the purpose of arming merchant ships to take their own part as merchant ships. I think very likely the question will arise, if a merchant ship takes upon herself to use weapons against an enemy's ship, whether she would be considered warranted in doing so. I think a ship would require some warrant from the Government to admit of her using weapons even in her own defence. That seems to me to be a point of difficulty. Another point, with respect to which Captain Crutchley perhaps has not had so much experience as I have had, is the fitting out of vessels, which he speaks of as being necessary for his purpose. I had occasion to fit out a vessel at the Cape of Good Hope, and I quite admit the use that that vessel would have been to the service, had she been required as a cruiser. When I first undertook to fit her I was under the impression that, in addition to all the fittings necessary to make her an armed cruiser, she would carry sufficient coal to be of use to the squadron in general, in fact, to become an armed collier, but by the time I had got all the weights necessary to make her an armed cruiser I found that there was not much room—I should say tonnage—left for carrying coal. I think that Captain Crutchley would find merchants indisposed to give up the weight necessary to arm them under ordinary circumstances. I do not see that there is any reason why an Officer commanding a mail steamer should not be able to sail his ship in the piping times of peace, and fight his ship as well as another man if it came to war. I believe there are a great number of our Officers who are commanding steamers, who would be perfectly competent to fight their ships in case of war if they had the necessary authority to do so. At the same time I believe the first paragraph of the paper we have heard read cuts the knot of the whole question, and that is that you had better trust to your heels and run away, and then I do not think there is any man-of-war afloat that would ever catch you in a long stern chase. I speak with a considerable amount of certainty of our own ships, and I doubt if there is any man-of-war afloat which, in the case of one of our mail steamers having, as Captain Crutchley describes, a start of ten miles, which would be increased by the time the man-of-war had got up steam to full speed, say to 14, would be able to catch that merchant ship. Men-of-war cannot get at their coal with sufficient readiness to enable them to keep up their high speed. I do not think that a merchantman such as Captain Crutchley commanded when I had the pleasure of making his acquaintance, namely, the "Mexican," which would go and go on at 14 knots, would have anything to fear from any man-of-war afloat. There is another point on which I must venture to express some little doubt, that is as to the crew accepting what we may call "war risks" in a ship not fitted out to do man-of-war's duty, but armed to protect herself. Even in the case of a ship fitted out to do man-of-war's duty I found great difficulty in getting men to accept war risks at any price. The Naval Reserve men of course had to come, that there was no doubt about, but there was great difficulty in getting men to accept the risks under any other circumstances. I am sorry to say some little difficulty has since arisen in some cases, and there is no doubt great hardship was inflicted upon certain members of the Naval Reserve Force which they had not expected, or at any rate had not realized when they joined it, and not only hardships, but considerable loss, both directly and indirectly. I think there are points of some importance with regard to expecting the crew of a merchantman to fight their ship. I beg to compliment Captain Crutchley on his very practical paper, and I shall be very glad to confer with him at any time on the subject, and to give him the

benefit of my experience, and to hear from him exactly how far his Directors are prepared to go; but until it is put on a plain footing I do not think we can ever arrive at any satisfactory results. I thank him very much for bringing this subject forward, as it is one of very great importance, and I also compliment him upon the ability with which he has brought it forward.

Admiral BOYS: I trust I may be allowed to congratulate this Institution upon getting a paper on this subject read here by an Officer of such practical experience as Captain Crutchley; and I may also congratulate the Mercantile Marine on possessing amongst its members an individual who is willing to take the trouble to collect and so ably put before us Naval Officers all the information it contains. I think the gist of the paper is comprehended in these few words:—"I do not see there is any reason why an Officer commanding a mail steamer should not be able to sail his ship in the piping times of peace, and fight her as well as another man if it came to war." Nor do I in the least, but my difficulty in this case is that, if a merchant steamer is to be a fighting ship and a merchant ship at the same time, she must be under two masters; there must be a dual control; because for her fighting arrangements she must be under the Government, under the Admiralty, and for her trading and cargo arrangements she must be under the control of her owners. That is a difficulty which might be overcome; but it is a thing to be seriously thought of. I was only last week reading a book lately published by a very eminent man, Mr. Froude, entitled, "Oceana," and we are there told that, when he was taking a passage from Australia to New Zealand (I think it was) in a large steam vessel, the captain said to him, "I make it a point never to take any Englishmen for my sailors, if I can help it. I much prefer Danes and Swedes, and all my servants and stokers are Chinamen." I should like to ask the lecturer if, from his experience, that is the case generally amongst the large merchant ships working in those waters, as it has a very important bearing on the subject before us. With regard to the war risks in connection with crews, that Admiral Salmon has alluded to, I think there is probably some misunderstanding, because, if any English merchant ship were attacked by an enemy's vessel, and there was the slightest chance of escape by a successful resistance, I believe the crew would defend her to the last, not only as Englishmen, but for the simple reason that it would be far preferable for them to continue their voyage in her than to become prisoners to the enemy, with a very uncertain future before them. For this reason only I think they would fight.

Lieutenant W. BADEN-POWELL: If I may say a word or two upon this subject, I should like to commence by saying that I must have been utterly misled by this paper in looking over the copy which I obtained from the Institution, for I read it as a question of calling out merchant ships in time of war, and arming them for offensive purposes. Now it seems the lecturer means that they are purely and simply to be armed for their own defence. There you come at once to the difficulty of the whole question of arming merchant steamers or any vessels except men-of-war, that you put yourself under the Declaration of Paris; and, unless you are under the orders of the Admiral of the station, and are part of the Navy of the State, you are a privateer, and a privateer, under the Declaration of Paris, is a pirate. Therefore you have the further difficulty that you will get no men to serve, or as soon as men, whether Naval Reserve men, or anybody else, find that the ship is not actually *bonâ fide* a man-of-war, they will probably leave, and I don't blame them. Admiral Salmon, with regard to Naval Reserve men, said just now that he found a difficulty in getting men to join a ship with war risks, and we found Naval Reserve men objected, but they had to come.

Admiral SALMON: I did not say that. I said Naval Reserve men of course did come; they had to.

Lieutenant BADEN-POWELL: I thought there might be some little slip of the tongue, because, as far as I am aware, Naval Reserve men have not yet been called out.

Admiral SALMON: The Naval Reserve was called out at the Cape, owing to the telegraphic communication having broken down.

Lieutenant CRUTCHLEY: Would you mind stating with what result they were called out?

Lieutenant BADEN-POWELL: They could not be called out without the Queen's Proclamation.

Admiral SALMON: They were called out by order.

Lieutenant BADEN-POWELL: I am afraid the order was wrong. The Act of Parliament only entitles the Naval Reserve to be called out by Queen's Proclamation in time of danger to the State.

Admiral SALMON: If you think it necessary, I will explain the circumstances.

Lieutenant BADEN-POWELL: Admiral Salmon quite rightly said, to my way of thinking, that the blue ensign, though called the blue ensign of Her Majesty's Fleet, would certainly not cover a fighting ship in war-time. There would have to be a warrant from the Admiralty, and Officers commissioned for that and for no other purpose. The whole vessel would have to be put under the State as a State ship, and, if the rules of the Institution would allow me, I have brought with me a pamphlet by a very eminent lawyer on the question of international law, from which we find that this very question arose in the Franco-Prussian War. He says, in the Franco-Prussian War the Prussian Government called upon the country to supply men and ships for the purpose of defending the State. France at once objected; England was asked to take the matter up, and England decided that in the Franco-Prussian case they were entitled to do what they were doing, because the merchant shipowner put his ship unreservedly in the hands of the State, and she became a man-of-war of the State, a part of the Navy of the State, and the men signed the articles of war, and wore the uniform and badges of the Imperial Navy according to their rank. That is the only point upon which the Law Officers of the Crown said that they were entitled to send those ships to sea without their running the risk of being captured as pirates; and it would be very hard lines for the men of our mercantile marine to be told that they would be perfectly safe under the blue ensign to defend themselves in time of war, and to find themselves left in such a hole that their only chance of having anything to say in the matter would be to write a letter half-an-hour or so before they were run up to the funnel, for I suppose there will be no yard-arms in future men-of-war.¹ These

¹ No occasion for the interpretation of the first article of the Declaration of Paris of 1856 arose in its application to a war, in which both the belligerent parties were signatories of that Declaration, before the Franco-German War of 1870, when the Prussian Government issued a Decree (24th July, 1870) relating to the Constitution of a Volunteer Naval Force. Under that Decree the King of Prussia invited all German seamen and shipowners to place themselves and their forces and ships suitable thereto at the service of the Fatherland. The Officers and crews were to be enrolled by the owners of the ships and were to enter into the Federal Navy for the continuance of the war, and to wear its uniform and badge of rank, to acknowledge its competence, and to take an oath to the Articles of War. The ships were to sail under the Federal flag and to be armed and fitted out for the service allotted to them by the Federal Royal Navy. The ships destroyed in the service of their country were to be paid for to their owners at a price taxed by a Naval Commission, and a sum was to be paid by the State as a deposit, when the ships were placed at the service of the State, which, at the end of the war, when the ships were restored to the owners, was to be reckoned as hire. The French Government, regarding the institution by Prussia of a volunteer naval force as the revival of privateering under a disguised form, lost no time in calling the attention of the British Government to the Royal Prussian Decree, as instituting an auxiliary marine contrary to Prussia's engagements under the Declaration of 1856. Earl Granville, on behalf of the British Government, referred the matter to the Law Officers of the Crown, and in accordance with their opinion returned for answer "that there was a substantial difference between the proposed naval volunteer force sanctioned by the Prussian Government and the system of privateering which, under the designation of "La Course," the Declaration of Paris was intended to suppress, inasmuch as the vessels referred to in the Royal Prussian Decree would be for all intents and purposes in the service of the Prussian Government, and the crews would be under the same discipline as the crews on board vessels belonging permanently to the Federal Navy." Upon these considerations the British Govern-

things are matters that should be settled and known, and seamen who take service in the Naval Reserve ought to know whether they are running risks or not; because it is all very well to say the Declaration of Paris won't stand in war, the fact is it does stand; in the Franco-Prussian War it was appealed to, and it was only owing to their throwing the whole of the Volunteer Service entirely into the hands of the Government that it escaped being a piratical institution. I have heard no such idea broached in this lecture. It seems to me simply that they ask leave of the State to arm their ships, so that they may fight if they are attacked at sea. I think Captain Crutchley would bear me out when I say that a merchant ship, such as our modern mail-steamer, one of those long ghosts of misery I was going to call them, for they very nearly are, is about the most unhandy thing that you can try to fight on sea. It is worse than any of your citadel-ships. It has only got a pair of heels to run away with, and if once it came in close quarters with one of the smallest corvettes it would be knocked into a cocked hat in a few minutes. Its steampipes are all exposed, its screw-propeller is far too near the surface of the water; the slightest ground-swell would pitch it out of the water, and a well-aimed shot would probably either take the rudder or the propeller. We have also to consider how this ship is going to perform the two duties of being an armed cruiser and carrying passengers and cargo. She cannot do it. She must for her armed cruiser purposes be under the order of the Admiralty, and the Admiralty, if it wants her, will stop her, and her perishable cargo of frozen meat, which the country would be most wanting in case of war, would have either to be eaten by the Fleet or to perish. It seems to me that the whole subject is much too large to be dealt with in a casual kind of a way between one set of ship-owners and, I was going to say a private Admiralty, a department of the State. It is a national question which ought to be discussed to-morrow, and other nations ought to be interviewed on the subject. I should like to say that, the sooner we drop the Declaration of Paris, the better. The Declaration of Paris did away with privateering; privateering was our strong arm for hurting other people, and I very much doubt whether any other country could combine to hurt us to the extent to which we could combine with our merchantmen to hurt them. Then we should be able to arm our merchant ships without question and do as we liked, and our merchantmen could look after themselves to a certain extent. There is only one other point which I should like to touch upon, that is, that Admiral Salmon said he came to the conclusion that when he had armed the merchant ships with the guns, and the weights necessary for them, there was very little room left for carrying coal. I do not know what the construction of that ship would be, but my experience of merchant ships is that many of them carry some 3,000 tons of cargo, and I should fancy the armament would certainly only come up to 30 or

ment could not object to the Decree of the German Government as infringing the Declaration of Paris. ("British and Foreign State Papers," LXI, p. 692. Perels. "Manuel de Droit Maritime International," p. 195. Paris, 1884.) There is not an unanimity of opinion amongst text writers on International Law on the subject of this Prussian Auxiliary Marine, as to whether its institution was in conflict with the Declaration of Paris or not. M. Charles Calvo, Ancien Ministre, considers that vessels equipped in accordance with the Prussian Decree may be regarded as privateers of an aggravated character, seeing that the owners are not required to give security for their good conduct ("Le Droit International." Troisième Edition. Tome Troisième, p. 303. Paris, 1880); and Mr. W. E. Hall, in his recent work on International Law, p. 455 ("International Law." Oxford, at the Clarendon Press. 1880), observes that "unless a volunteer navy could be brought into closer connection with the State than seems to have been the case in the Prussian project, it would be difficult to show that its establishment did not constitute an evasion of the Declaration of Paris." But neither of these eminent publicists seem to have given sufficient weight to the provisions of the Prussian Decree, under which the Officers and crew were required to enter into the Federal Navy for the continuance of the war, were to wear its uniform, and to take an oath to the Articles of War. Further, the vessels were to be fitted out by the State, and were to sail under the public flag of the State.

40 tons with ammunition, so that, even taking it at 100 tons, we should have something like 2,000 to 3,000 tons left for carrying coal. That again shows where the Navy would be; a wily Admiral would say, "Come along with me with your armed merchant ship, and have her full of coal," for by that means he would have a collier always alongside of him. Then, as to the crew, where are you going to get all these Naval Reserve men from to man these merchant steamers? It is not so very popular a Service already. There was a very long speech made the other night in the House of Commons on the Navy Estimates, in which it was said that Naval Reserve men were very scarce, and that out of these large mail-steamers there were very few indeed that had Naval Reserve men on board. I think that is perfectly true. Owners, as a rule, do not like to carry Naval Reserve men, because they are afraid that on a declaration of war they would have their best men whipped out of the ships at the very time when they could not get foreigners to serve in their place, because foreigners would not dare to serve under the English flag in war-time. So that it seems to me the questions opened up by this excellent paper are larger than were anticipated when the lecturer commenced. They are national questions, and of the most important nature that you can imagine. I look with distrust upon the whole subject of depending upon the merchant navy for fighting purposes in war-time. I think it is only a plant on the British public, it is only trying to keep the British public from clamouring for those handy fast corvettes of the "Esmeralda" type that we ought to have to keep our commerce in its proper place; and, if the merchant shipowner pays his taxes for a Navy to look after his commerce, he ought to have it, and ought not to be expected to keep his own policeman to protect his house against the robber.

Admiral SALMON: I may, perhaps, explain that at the time of the Russian War scare the telegraph wire was interrupted between England and the Cape. I had occasional communications by steamer, and by one of those steamers I received orders that, if I got no further orders within ten days, I was to call out the Naval Reserve, because by that time the Queen's Proclamation would be out. The cable remained interrupted, ten days passed, and I called out the Naval Reserve, and did the best I could with it. I think a little mistake must have been made by Mr. Baden-Powell in saying that I said that there would be no *room* left for coal; what I said was that there would be no *tonnage*; I think that, if he calculates up Captain Crutchley's 12 feet of coal round his engines and boilers, and the vulnerable part of the ship, he will find that it comes to a considerable tonnage; we have plenty of room, but we have not got tonnage. I speak from experience because I have tried it.

Admiral FREMANTLE: We seem to have digressed a little from the paper itself, and, as it will be in the memory of a great many of us that we had, I think, three interesting discussions on the question of the Treaty of Paris, than which no more interesting question can be discussed, whether in this theatre or elsewhere, I think we should be well advised in not going further into that subject. I must say I was a little surprised at the contention that an armed merchant ship was contrary to international law. I certainly did understand that, by the Treaty of Paris, privateering was abolished, but are people not allowed to fire a shot in self-defence? I think such a suggestion will be a new light to some of the people here present. Lieutenant Baden-Powell has, I am aware, given a great deal of attention to this subject, and perhaps he may be right, but certainly there were a great many cases in the old war of armed merchant ships defending themselves, and with success, against ships of the enemy. Those vessels were not privateers in the sense in which a privateer is generally understood; they certainly bore no letters of marque. I would simply mention the case of the "Warren Hastings." She was an East Indiaman, equipped to a great extent for war very much in the same way that our lecturer proposes, and she fought an action, though not a successful one, against a French frigate, the "Piémontaise," but it was an action on very nearly even terms. The French frigate was very well commanded, and at length succeeded in taking her; but that was not looked upon as any question of privateering. So that I venture to think there may be a distinction between a merchant ship armed for self-defence and an armed merchant ship which carries letters of marque and is intended to prey upon an enemy's commerce. The essence of the whole question now before us is that of speed. Unless it was the fact that our merchant ships are

vessels of very great speed, a speed which I am afraid we can scarcely equal in the Navy, the question of their cruising alone, and not in convoy, would scarcely be taken up. Lieutenant Crutchley says, "There are very few men-of-war afloat that in war-time could afford the time and coal expenditure necessary to catch a 14-knot merchant steamer." I am afraid most naval Officers here will entirely agree with him on that point. I took the trouble to look through the Navy List somewhat hurriedly yesterday, and I think I am not very far wrong when I say that amongst the men-of-war, those actually afloat, counting those that are fitting, but not those still on the stocks, I made out that there were only about thirty or forty which were capable of going at 14 knot speed, even for a matter of twenty-four hours. I included in that category vessels such as the "Dreadnought" and "Thunderer," whose speed is about 14 knots, and they may probably keep it up for twenty-four hours, but, as for keeping it up for a week, they could not do it. I do not believe there are a dozen that could keep it up for a week.¹ Under these circumstances, it adds great importance to this question of whether a merchant vessel should be armed or not. If we are not to have armed merchant vessels, and if international law does not allow them to be armed, though, as I say, that is a new light to me, I think there is no question that we should be bound at once to build a large number of "Esmeraldas." On that point I agree with Lieutenant Baden-Powell. There is a question as to the weights of the armament. I have an old lecture here of Captain Long's, a very able lecture, treating on the same subject from an entirely different point of view. His calculation was for ten guns, and he gives the total weight for guns and ammunition as 81 tons. He alludes very fully to the question of the merchant steamer, and puts the largest of such vessels as 450 feet in length. But that is not the extreme length of the steamers we have at the present day. We know very well that some of our new vessels, the "Etruria" and the "Umbria," are 550 feet in length. The reason I allude to that is that I should have very much liked the lecturer to have gone into the question a little more fully in some respects, such as whether in these very large and long vessels, like the unfortunate "Oregon," which went to the bottom the other day, where they have the large compartments which we know Sir Thomas Symonds speaks of as "large sinking compartments," and what effect one of those large compartments being filled would have upon the immersion of the ship. That is a very large question, because it seems to me that none of these merchant ships are at all capable of anything like efficient defence unless their compartments are of that size that one or even two might be filled without the ship going to the bottom. That can never be done till we have double-screws in our merchant ships, and there again we touch upon a question of the highest importance. With double-screws you have two engine-rooms, the ship is divided fore-and-aft, and consequently the "sinking compartments" are only one-half the size. The question of the area of the rudder, as Captain Long points out in his lecture, is of great importance. In the merchant-ship that he refers to there, he gives the rudder area as 125 feet, that of the "Minotaur" being 198 feet, and that of the "Agamemnon" 143 feet. The standard which he takes is the area of the midship section divided by the area of the rudder. He has taken one of his long merchant ships, "Atlantic Mail Steamer" he calls it, and he puts her coefficient as 92. I was alongside him at Malta in December, 1884, when he was trying his circles in the "Agamemnon," and our attention was naturally directed to this subject. The coefficient for the "Agamemnon" was 46, or exactly half. People are perfectly aware that the "Agamemnon" did not steer well, but the fact is she was like a dish, she turned a great deal too much, and her failure to steer was certainly not due to want of rudder surface. The "Dreadnought's" coefficient we found to be 51. From 46 or 51 to 92 is a very large step, and, unless merchant ships can have larger rudder surface in proportion to their size, and can have double-screws so as to enable them to steer by the screws in case of injury to the rudder or steering gear, I must say I do not see myself how any merchant ship can make any effective

¹ Having looked more closely into this subject since, I much doubt if we have a single vessel belonging to the Navy afloat capable of steaming 14 knots for one week. Possibly the "Iris" and "Mercury" could, but those who know these ships best are not sanguine on the subject.—E. R. F.

defence against even the smallest of corvettes. I wish specially to thank the lecturer for the practical way in which he has treated this subject. The question of whether merchant captains should be allowed to command their own ships in case of war, if fitted as cruisers, would depend on their being capable of commanding them efficiently if commissioned as men-of-war. I think there is very little doubt, if these Officers will take the trouble to pass through the present course, and if, in addition to that, they were able to go to the "Excellent" and improve themselves still further, there would be no reason why they should not be allowed to command their own vessels—at least it seems to me it might be so. I am one of those who do think it is perfectly impossible to have a reserve of Naval Officers for service in the Navy in case of war, and under those circumstances we certainly ought to turn to our Royal Naval Reserve Officers. This, indeed, sounds like a truism, and I am extremely glad that during the past year some of those Naval Reserve Officers did go out with the fleet, and, as I understand, made a very good impression, and I hope it will be a course which will be followed more fully in the future.

Sir NATHANIEL BARNABY: I have listened with a great deal of interest to the very remarkable paper which has been read. It gave me very great pleasure to find an Officer of the Royal Naval Reserve venturing into the midst of the Naval Officers here and reading a paper of that kind, and it has given me more pleasure to find how well it has been received. It is a very difficult subject. Some of the points mentioned by Mr. Baden-Powell are no doubt accurate, but with some I do not at all agree. One thing may be taken as true, namely, that in time of war any merchant ship could, by having the Queen's commission given to her, be authorized to defend herself; that is all we require. But the question as to what she could do may, I think, be best looked at in this way. Supposing that off one of the ports, where large numbers of sailing ships and slow steamships are coming and going at the outbreak of the war, there is one of these merchant ships, which some Officers think so weak and so incapable of doing anything, belonging to our enemy. Suppose she has only one screw—well, it is a poor look-out when a ship has only one screw!—she is very narrow—she would be a great deal better ship if she were wider—still there she is, she is fast, she has got a lot of coal, she has fighting men on board, and she has guns. What, I should like to ask, is going to happen to the sailing ships and the slow steamships; what can they do? You may say that, not being a regular ship of war, the enemy's ship ought not to be able to do anything to them. It is perfectly certain that she will, and the question we have to consider is, can we by any extension conceivable of the regular forces of the Navy make shipowners feel secure, when war is declared, that they would not have their ships snapped up? I say that you cannot: that you may spend as much money as you please, and you never will make your shipowner comfortable if he is dependent for the defence of his slow ships all over the world on what you can do for his defence with your regular ships of war alone. Consider what would be the result if the enemy with whom you are contending got hold of some of your despised and fast cruisers, and armed them and sent them out against your commerce. It is not the question as to whether the "Oregon," if she had been met by one of the regular ships of war, say the "Inconstant," or some vessel of that kind, would not have been in a very bad case—that is a debateable point—I should be very glad to debate it. My opinions might not agree with some of yours. I think the "Oregon" was a very good ship. The fact that she floated for 8½ hours is something very much in favour of a ship of that kind. And I can tell you something else about the "Oregon;" she might have had *any two* of her compartments filled with water, and she would not have sunk, had her doors been shut. I do not wish to say anything about the ship which is commanded by the gallant Officer who has been speaking to us. She is on the Admiralty list, but she is not a ship to compare with the "Oregon." But the "Kaikoura," if she were commanded by our friend and were sent to attack an enemy's commerce, you would find, I believe, would make a very good account indeed of any ship that she might come across. I have been talking to Naval Officers for years about this matter, and I am pretty well tired of it. The Naval Officer believes very much in the Broad Arrow; but after all he has to consider the wide question I put just now: can the merchant shipping of this country be defended by any expen-

diture conceivable upon the *regular* Navy? I say it cannot. If you think you can show that it can, then I most sincerely wish you would join in getting the ships. If you think it cannot, then consider what would be the state of things without good merchant auxiliaries when war broke out, looking at our vast merchant marine with half its tonnage sailing, and a vast proportion of its steam tonnage very slow. My own belief is that, until we have the question considered deliberately, thoroughly, and exhaustively in the light of the facts which were put before Lord Carnarvon's Royal Commission, we never shall get a settlement of the question. As to giving up the Declaration of Paris, I should fight against that with all my soul. I believe it would be entirely wrong to go back upon that, and that we are in a far better position with it if we will only use our advantages rightly. The question really is, I think, not what the owners of the "Kaikoura" will do for the Government, as one of the speakers has asked, but what the Government will do for the owners of the "Kaikoura" and of such ships.

Captain CURTIS: We have been asked by the lecturer for a precedent with regard to merchant ships defending themselves against an enemy. In the Governor's room of Christ's Hospital I have seen a picture of Commodore Dance, in the H.C. ship "Earl Camden," with 15 other Indiamen and 14 coasting ships under convoy, beating off a French squadron of men-of-war, consisting of the "Marengo," 84 guns, bearing the flag of Rear-Admiral Linois, and two 44-gun frigates, a 28-gun corvette, and a Balarian 18-gun brig, on the 15th February, 1804, off Pulo Aor, in the China Seas.¹ I freely concur with previous speakers in thanking Lieutenant Crutebley for this lecture, and it no doubt requires some amount of boldness to come before an audience of Naval Officers with a paper of this sort, and subject it to their criticism. With respect to guns, Lieutenant Crutebley doubted the use of having machine-guns. Now, if a torpedo-boat is coming up under your stern or quarter, that boat will be some time under fire, and I have heard Admiral Lethbridge say in this theatre that truck guns are of no use on board these ships. I have seen truck guns in a ship off Cape Horn in a swell, when the decks were wet, take charge when the falls were bracketed, swaying fore and aft, and the men jumping over and mounting the guns to prevent their being jammed against the ship's side. You must have a gun on slides. With respect to the coals, I think, as a whole, the coals would soon empty themselves out. I can understand coals giving resistance because they yield to the shot. A great many of the gentlemen present have no doubt seen Admiral Sir Thomas Symonds' letter in the "Morning Post," in which he states that there are only 150 powerful merchant ships. He says we shall require all those ships to supply our food, and in fact, in about three weeks we should be starved out if our communication with America was stopped for that time. It is quite evident that merchant ships should be able to defend themselves against foreign ships of their own kind converted into commerce destroyers.² Foreign Governments, especially Russia and France, threaten to arm their merchant ships to prey upon ours, and I think it is very hard that our ships may not defend themselves against such ships.³ Sir Nathaniel Barnaby wrote a long letter in the "Times" the other day, and, as he states, patriotism cuts both ways. What will the Government do for the people, and what will the people do for the Government? The "Oregon" and other ships have carried their water-tight bulkheads right up to the main deck, with the result that, instead of the ship being advertised as "copper-fastened, and carrying an experienced surgeon," it will be said that it has "water-

¹ This picture was presented by the Society of East India Commanders to Captain Charles Shere, late of the H.C. own ship "Buckingham," on the 15th February, 1851, he having been in the action; he was an old Blue, under King Charles's Foundation.

² It appears similar to shearing Samson of his hair; our strength is in our commerce. Portugal, Holland, Spain, France, and England have contended for the commerce of the high seas. We have got it; let us keep it.

³ "Alabamas," for instance; from an article in the "Century" for April, written by a foremast hand, the crew were more like pirates; a Scotchman sagely remarked she had never been in a Southern port, and suggested rushing aft, taking the ship from the Officers, and handing her over to the Northerners for 100,000 dollars.

tight compartments, and won't sink for some seven or eight hours or more." That will be a considerable inducement for passengers to go on board those ships. I think that the wool, as Lieutenant Crutchley has told us, is a considerable protection. With respect to transports, Sir Thomas Symonds says that our Government should do their own transport. I fully concur in that. The Government has never had a better ship than the "Himalaya," and I have no doubt she would give a very good account of herself if required. I think there is no excuse for educating our boys in training ships as they are educated ashore, and keeping them cramped up in harbour. It has a very deleterious effect upon the boys' morals. When a boy is anxious to go to sea, and to visit foreign countries, to keep him cooped up in harbour ships is not only injurious to health, but to morals; he should have three months' drill only. It is not derogatory to carry coals or anything else for your own country. I think it is an honourable profession, and I should say that during peace-time we should do our own transport, and then, if one-third of the crew and the captain were left on board in war-time, the crew could be filled up by merchant seamen thrown out of employ in sailing ships and slow ships, and in that way they would be trained, and would become more or less men-of-war's-men. On the coast of Africa and South America our transports were men-of-war, and were commanded by navigating Officers, and were always in a very creditable state. In the Crimean War a steamship came into Balaklava with boots on board, and yet they sent the ship back to Constantinople for boots. That would not have happened on board a naval transport, because there would have been a court-martial, and somebody would have had to answer for it. It is quite time that the Government did their own transport. I think that, if your commercial marine is worth so much, and increases in value, you must give so much more money to protect it; it is a simple matter of naval insurance.¹

Lieutenant LOWRY: It seems to me that the right key-note has been struck by the lecturer in saying that merchant steamers must be armed to defend themselves, and not to take the place of men-of-war. I happen to have gone over, not the "Kaikoura," but one of her sister vessels in New Zealand, and I went rather carefully into the subject of her armaments and her suitability for a cruiser. There are a great many defects, as we all know, in ocean steamers with reference to their employment as armed cruisers, and one of the greatest of all has been very well brought out by Captain Long, namely, their bad manœuvring power. He compares a French 4,000 ton corvette with an Atlantic liner, the tonnage of the one being about 12,000 and the other about 4,000; the speed of the corvette 12 knots, and the Atlantic liner 16; diameter of turning circle, French corvette 341 yards, the Atlantic liner from 800 to 1,200 yards; time of turning the circle, 6 minutes for the man-of-war, 10½ minutes for the merchant steamer. Captain Long, in summing up the question of manœuvring powers, says that "so unhandy a vessel dare do nothing but turn her stern to a hostile ship when a mile off." I happened to be coming home from the Australian station at the same time as the "Kaikoura" was on her journey. We had to pass near a large Russian squadron, and, if there was one thing more than another which our Captain prayed for, it was that they would try to come to close quarters with us. The lecturer speaks of two armed merchant cruisers meeting a man-of-war, and he thinks that they would very soon be able to dispose of her by ramming. I do not think they would. I would be very glad, in a small handy ship steaming 12 knots, if the long ocean steamship steaming 16 knots would only try to come to close quarters. Again, we must consider the want of protection of engines and boilers in many of the large Atlantic liners; I am told it would be very difficult to get more than 4 or 5 feet of coal anywhere between the ship's side and the engines and boilers; the engines can be protected, but the boilers cannot. Then, as to the guns' crews, if we take one example of a merchant steamer which has been armed by the Admiralty—the "Hecla"—anyone looking at her will see how utterly exposed the guns' crews are, and if they got to close quarters with

¹ Instead of our Lieutenants being retired,—also Commanders,—they should be given a step in advance, and employed in the Colonial Navies, to rank with, but after, Officers who hold commission of the same date in the Royal Navy: promotion in our Royal Navy need not then stagnate.

one of our ordinary high-bulwark corvettes those guns' crews would stand a very bad chance against rifles and machine-guns. The decks are very much exposed to fire. We also hear it very often stated that the bulkheads of many of these steamers are desperately weak. Whether or no the "Oregon" was lost through that I cannot say, but I know this, that in one of our men-of-war one compartment was filled to within 2 feet of the water-line when the water came spouting through half the rivet-holes, and I do not think that bulkhead would have stood very long without some of the rivets giving way. Then, as to the length of side, taking an Atlantic liner, and supposing that she had six or ten guns, she exposes something like four or five times as much area as a man-of-war of the same tonnage. She presents a target four or five times greater, and the chances of hitting her are therefore very considerably more. The need of careful preparation beforehand was very well emphasized by Lieutenant Crutchley. I went over the stores at Sydney provided for arming merchant vessels, and the guns there consist almost entirely of 64-pounders. The Russian vessels they would have had to meet carried new Krupp guns, a large armament of 4-pounder shell guns, and quick-firing machine-guns,—with which we are utterly unprovided at present on these foreign stations,—and have also actually 600 men. Now it would be a very long time before we could raise 600 men to arm any considerable number of our merchant steamers. With reference to the efficiency of the Officers, I have lately been serving in the Reserve Squadron with some of those who had the pleasure of serving in the Evolutionary Squadron last year, and one and all spoke most highly of the thoroughly efficient way in which the work was carried out by Officers of the Royal Naval Reserve. As a gunnery Officer, I think we should very warmly welcome our brethren of the Royal Naval Reserve on board the "Excellent" for training. I think that is one of the very best suggestions I have heard to-day, and I think I may say for the Officers of the "Vernon" that they would be very glad to see them too. I feel we ought not entirely to neglect the question of torpedo armament for these ships. With these vessels steaming 16 or 18 knots, the opportunities they would have of using the Whitehead would go far to equalize the chance of their coming successfully out of an engagement if they were ever obliged to accept an engagement with a man-of-war. What we heard about Officers of the Royal Naval Reserve giving up almost all the little leave they have to go through a course of gunnery training is, I think, a lesson to all of us, and it ought to induce the Government to meet in a liberal spirit the wishes of men who will put themselves to such a sacrifice as that. I have during the past three months had something to do with the gunnery training of the seamen of the Naval Reserve, and I can only say, after carefully supervising it, attending most of their drills, and examining most of the men myself, that the drill efficiency is decidedly good. I do not consider it smart, but it is good. The trained men of the Naval Reserve are quite up to the average of trained men of the Navy. One great drawback seems to me that they are drilled just at the one kind of gun with which the ship on their station is armed; for instance, on the "Penelope," at Harwich, they are drilled with the old 8-inch muzzle-loading guns only, and so at other stations. They get very little variety of drill, and the result is that men drilled, say on a turret-ship, know nothing of the guns that they would have to fight on board merchant steamers. I wish I could speak in as high terms of their shooting efficiency; they get little or no actual firing in the Reserve ships, most of which lie in close harbours where "short practice" is impossible. Not one in ten can even lay a gun accurately with the ship steady; what they would do at sea in a lively ship at a moving target I can only imagine, so that we must trust, as far as Nos. 1 of our guns go, almost entirely to men of our own Navy. The suggestion about a gunner's mate on board these steamers as gunner seems to me an exceedingly valuable one. It is no doubt very difficult sometimes for the Naval Reserve men to take up the whole of their drill without losing their appointment on board seagoing ships, and so losing their seaman's efficiency. That suggestion is worth careful looking into. I think you could by arranging temporary billets send men there for a year or two years, and then withdraw them. We all know that if men are left in a billet where there is no close supervision put over them for a long time they are liable to get rusty. If some such arrangement was carried out, I have no doubt the men would get a good training, and a training at the guns

they were required to fight at. They would get perhaps a fortnight's drill, which would count for an ordinary week of the training in the Reserve ships. Admiral Salmon spoke of the difficulty of getting men not belonging to the Naval Reserve to enlist; I am very glad to quote an instance in which there was no difficulty. When we were leaving Sydney, without any pressure at all, by merely passing the word round amongst the local seamen, we had five men who presented themselves at once, offering to be enrolled, and many more said they would come if they thought war was certain. When we got to Singapore, the Captain of one of the corvettes told me that they had enrolled twenty extra hands during the war scare. All our Lieutenants on the Active List are pretty well employed now; we want a great many more Officers if it comes to war, and I am heartily glad that we have such Officers as Captain Crutchley and many others of the Royal Naval Reserve to back us up when we come to the scratch.

Lieutenant CRUTCHLEY: Admiral Ommanney asks whether the defensive power of the ships I spoke of are equal to the Admiralty requirements? Yes. Of course there are many things that might be altered for the better. I do not think the shipowners would consent to increase the crews of the vessels unless they received a subsidy for doing so. With regard to the right to use weapons, the subject has been taken up by several speakers. If a man comes to me and demands my purse upon the high seas, I do not see why I am to be hanged as a privateer or pirate if I make the best defence in my power. I do not advocate the armament of these ships for offensive purposes, but, as I put it, seeing that we might be leaving New Zealand, not knowing whether war was declared or not, and looking at the enormous value of one of these solitary ships, and their power of doing damage if they were captured by an enemy, my wish was to point out the necessity of giving them something to defend themselves with against any chance antagonist. As to the matter of the crew being willing to accept the war risk, I can only speak for my own crew, and I am certain every man would have followed me on the occasion I mentioned, had they been asked to do so. Admiral Boys wishes to know whether merchantmen generally prefer carrying foreigners to Englishmen. I do not think, in the better class of ships, that foreigners are admitted if you can possibly get Englishmen. Every preference is given to Englishmen, and I am certain the better class of shipowners prefer shipping Naval Reserve men to any others. I do not think they are as liable to go wrong in a foreign port; they stick to their ship and come home again; they are not so given to desertion as the ordinary run of seamen. I do not know that I can answer Mr. Baden-Powell's arguments, I am not well enough up in law to do that, but I think the same argument applies as to 'Admiral Salmon's remarks, "that we do not arm the ships to go and look for enemies, but simply to defend themselves." He (Mr. B.-Powell) says a merchantman would be knocked into a cocked hat if it came across anything carrying guns. Perhaps she would, but you are not going to be always hit below the water-line, and a shot from a heavy gun, if it did not hit her engines, would go clean through, and you could plug up the holes. It would appear that an ordinary man-of-war could not catch a fast merchantman; only a similar vessel to herself could bring her into action, and then the argument would hold either way. Admiral Fremantle quotes the "Oregon," and asks what will happen if the fore compartments were filled with water. I did not take the "Kaikoura" as the best ship that can be pitched upon, because we know that, were her biggest forward compartment filled, she would draw, as nearly as I can get it, assuming she were loaded for a draught of 24 feet, the fact of the biggest foremost compartment being filled would put her down to 29 feet. Of course that would not render the ship absolutely unseaworthy, and, though she would not be the sort of ship you would like to go to sea with in a gale of wind, there would be a fair chance of getting to port. I simply wish to point out that we must make the best of the materials we have got on hand. Of course, if we could build these ships with twin screws, and subdivide them into more compartments, it would be a great deal better, but, with the ships we have, my object is to give them all the security possible. Of course you could arm them better. You could put machine-guns into them, but let us have something to strike a blow with in our own defence.

Admiral FREMANTLE: My question was whether, taken from a mercantile point of view, you thought there were any special objections to their using them.

Lieutenant CRUTCHLEY : None whatever. I am putting my wishes as modestly as possible. With regard to the manœuvring power of these ships as opposed to a corvette, undoubtedly the corvette, if she could get a chance to get the inside circle, would give her stem and ram her ; but I was very careful to say, two of these ships opposed to a corvette, and I think, even with their bad manœuvring power, two merchant ships would be able to give the ram blow, as, if one did not get her, the other would. I have now only to thank you very much for the kind manner in which you have received my paper.

The CHAIRMAN : I have now to ask you to give your thanks to Lieutenant Crutchley for his interesting lecture. I had hoped myself to have said a few words upon this question, having been so much mixed up with the Reserves for a few years. However, the time is getting so late that I have made up my mind to say nothing on the point beyond this general remark that it is very satisfactory to hear so many people who know the matter speak so well of Naval Reserve Officers and Naval Reserve men. My opinion is that in time of war they would be the mainstay of our nation.

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MAJOR-GENERAL SIR REDVERS H. BULLER, *M.C.*, K.C.B.,
K.C.M.G., in the Chair.

"THE FIELD TELEGRAPH," ITS USE IN WAR AND ITS
EMPLOYMENT IN THE LATE EXPEDITIONS IN THE
SOUDAN AND SOUTH AFRICA.

By Major C. F. C. BERESFORD, R.E.

FROM the very earliest ages attempts have been made to invent rapid and secret methods of communication for the purposes of war. The greatest development in this direction has, however, taken place within the last quarter of a century. The electric telegraph has been surely and rapidly spinning its web round the globe.

Space and time have been practically eliminated from calculations for keeping human enterprises in motion, and as war keeps pace with every other enterprise, each new scientific appliance finds an opening in military organizations.

Mr. Plum, the historian of the telegraphs in the American War, remarks: "Like a few great actors who play all parts well, the telegraph upon the stage of life is successful in every rôle, but like them it has its specialities."

It will be my endeavour to show how many different rôles are open to the military telegraph, and to point out what its specialities are; but before it can have full justice done to its capabilities, the interest and sympathy of every branch of the Service must be enlisted.

In almost all armies the telegraph, in its earliest stages, has been snubbed and neglected, not to say opposed; as a well-known authority on the subject, Herr von Fischer Treuenfeld, observes: "The opposition shown to it by many commanders, as being prejudicial to their independent action, is frequently due to an improper ambition, and to a false conception of strategic principles. The most

important principle of modern warfare, *i.e.*, the union of extended action under a single will, being too frequently overlooked." In the Franco-German War, the German telegraph, though one of the chief elements of their success, was at the outset impeded in every kind of way. No proper transport was provided, the detachments were pushed off the roads to make room for other corps, little or no assistance was given in maintaining the line; the poles themselves were frequently used to feed the bivouac fires.

In the Russo-Turkish War of 1877, during the march from the Caucasus to Asia Minor, the field telegraphs were frequently destroyed by wagons and by soldiers, and the poles used as firewood. On complaint being made to the Army Commander, the only consolation received was, "That it was inadmissible in a woodless region to ask the poor sick soldiers to spare the telegraph poles;" and yet the action of the Army depended on an unbroken line of communication some 750 miles long.

In our Army for some years the Field Telegraph Troop at Aldershot was regarded by many as a harmless amusement provided for Engineer Officers at the expense of the taxpayer, and it was much admired as it marched past in the Long Valley. For all that it was quietly doing good work in training Officers and men, and the result of that training has been fully recognized by Generals who commanded in late expeditions.

The greatest triumph achieved by the telegraphs over prejudice has been in China. The difficulties with the French forced upon the Chinese Government the necessity for, among other things, connecting Canton by telegraph with the borders of Tonquin. The characteristic opposition of the Chinese populace to foreign innovation showed itself at once, and all kinds of means had to be taken by the Government and the Danish Engineers, who were in charge, to circumvent the superstition of the people.

It is told how the following explanation was given to awe the inhabitants.

The telegraph poles were said to be inhabited by devils, and were placed close enough together for the devil in one post to be heard by the devil in the next. The wire was merely for the purpose of keeping the posts upright, as a slanting position made the devil inside feel very uncomfortable. These devils spoke a language only known to foreign devils, one of whom was at each end of the line.

Sketch of the History of the Use of Telegraphs in War.

The honour of introducing the telegraph into war is due to the British Army in the Crimea, when short lines were used for connecting the camp before Sebastopol with the harbour, and the several headquarters with one another.

In 1857 it was again used during the mutiny in India, and Lord Clyde's advanced posts were enabled by its means to communicate with Calcutta. The dryness of the soil permitted long lines of bare wire to be laid on the ground without any insulation, though heavy

dews must have seriously interfered with the working. The telegraph, however, is reported to have done excellent work.

The same year the French had a field telegraph in Algiers, and in 1859 they made considerable use of it during their Italian campaign.

Up to this time telegraphs in war had been merely used to connect headquarters with the base, but in 1859 the Spaniards, under General O'Donnel, took a light equipment with them to Morocco, and made successful use of it for outpost work during their campaign in North Africa. A cable had been laid from Tarifa to Ceuta to keep up communication with Spain.

Since that time the Spaniards have developed their equipment with a view to adapting it to outpost and mountain warfare, and its leading characteristics now are, that it is carried by pack transport and is extremely light and portable.

In 1860-61 the Italians were the first to regulate, by means of the telegraph, the advance of two separate columns marching on the same strategic point, but separated by natural obstacles.

Ancona was held by a body of Irish and Belgians, under the French General Lamoricière, when Victor Emanuel determined to invade the Papal States. Two columns of 10,000 men each, one on either side of the Apennines, were directed against this place. Their combined action was completely successful, and entirely due to a judicious use of the telegraph.

In 1864 the Germans made use of the telegraph in their war with Denmark, and at the assault of Düppel there was a field station established close to the position taken up by Prince Frederick Charles, by means of which he received on the field of battle a congratulatory despatch from the King of Prussia.

The Civil War in America.

Up to 1861 telegraphs had been looked upon by commanders as indeed a useful auxiliary, but also as a luxury of war which time might possibly develop, when suddenly there burst upon the world the civil war in America. Before the beginning of that struggle the Federal States possessed neither a State telegraph system nor a field telegraph corps, only a signal corps used chiefly for surveying purposes on the Indian frontier.

The telegraphs of the country were in the hands of three private companies.

Grasping to the full the possibilities within reach, the Federals unhesitatingly seized all the telegraph appliances and personnel, and made such a thorough and rapid use of them, that in a few months the war may be said to have been entirely conducted by means of the telegraph.

It was used for every conceivable purpose, whether for maintaining communication with the base, or between different bodies of troops on the march, in camp or on the battlefield; for reconnaissances, sieges, and outposts.

At the battle of Fredericksburg, 13th October, 1862, it was extended from the headquarters to either wing, and another line fol-

lowed the first advance when made. The operators were exposed to severe fire, but held their ground. Constant and reliable use was made of the telegraph during the battle.

Throughout Sherman's march his headquarters were daily in communication with the base two hours after halting.

Mr. Plum, who took an active share in the operations, states that frequently he had been in telegraphic communication with Officers while they were fighting to maintain a position, and at one time with an operator inside a stockade which was being attacked, the wire, for some unaccountable reason, not having been cut. He also says: "Battle orders by telegraph became the usual means of moving troops, and that was the main object of the service."

At the battle of Petersburg, 2nd April, 1865, a telegraph station was established 500 feet behind a battery engaged, and remained working throughout. Corps Commanders frequently conducted entire expeditions from the telegraph tent without getting on horseback.

At the close of the war not only the headquarters of four armies, representing 250,000 men, many miles apart, but the outposts themselves were connected by wire with General Grant's tent in Culpeper. Over 8,000 miles of wire were in use, and more than 1,000 operators had been employed.

There is one point I wish to draw particular attention to, and that is, that at the beginning of the war the Telegraph and Signal Corps were organized as separate services. This system was found unworkable and inconvenient, and after a few months was abandoned, and both were placed under the command of General Stager.

War of 1866.

In 1866 we see how the telegraph can minimize the disadvantages of combined armies operating from divergent bases. The three armies of Prussia advancing on Bohemia were in unbroken communication with each other through Berlin, where General von Moltke held the ribbons in his own hand. The concentration on a single point was timed to a day. The hazardous operation of two armies crossing a mountain barrier at 60 or 70 miles apart to meet a concentrated enemy was stripped of its danger, and Königgrätz was a triumph for the telegraph.

The War in Paraguay.

During the war between Brazil and Paraguay, which lasted from 1864 to 1869, the telegraph was largely used by both sides for tactical purposes. The flank movement by which the Brazilians and their allies forced the Paraguayans from the lines of Angostura and Loma was only rendered possible by the use of the telegraph.

General Lopez endeavoured to direct everything during that campaign by telegraph from his own tent, which I believe was, as a rule, kept well out of fire, while the forward stations during a battle were in the thick of it. His Director of Telegraphs was Herr von Fischer

Treuenfeld, who is now well known, not alone in this country but also in Europe, as the greatest authority on military telegraphs.

The Abyssinian War.

In 1867 England sent out a telegraph detachment to Abyssinia, where about 250 miles of line was run up country, for the purpose of facilitating communication with the base.

Use in Spain.

In 1868, at the suggestion of Marshal Prim, an outpost telegraph system was established in Spain, for the purpose of keeping up communication between the advanced guard of a cavalry division and the main body. It did good service in 1868 at the battle of Alcata, but at a later period was given up, owing to the number of cavalry soldiers required to work it.

Franco-German War.

The Franco-German War of 1870-71 proves that Germany had been well aware of the valuable aid to be sought for from the telegraphs, and had a system carefully elaborated and ready, without which, as her Officers have acknowledged, she would not have dared to invade France as she did.

There were three organizations :—

The Field Telegraphs.

The Etappen Telegraphs.

The State Telegraphs.

The duties carried out by each are clearly explained in a work recently published, "The Organization of the Electric Telegraph in Germany for War Purposes," by Major-General von Chauvin, Director-General of Telegraphs.

Extracts from this work, translated by Captain Hare, R.E., will be found in Nos. CXXVI and CXXVII of the Journal of this Institution.

The network of telegraphs in the Rhine provinces having been organized with a view of converging all the main lines of communication on Berlin, a system for utilizing the French trunk lines running from the frontier towards Paris was then taken in hand; this was the duty of the State telegraph detachments.

Several of the great main parallel lines were selected, those destroyed were repaired, cross lines erected, and centres of telegraph direction arranged as the armies advanced. On the country being occupied, civil government centres were established and telegraphic communication adapted to them. At the close of the war a vast network of State telegraphs in complete working order covered the country.

The State telegraphs not being able to keep pace with the advance of the various headquarters, these were connected with each other in the first place by the field telegraph detachments, whose lines were after-

wards relieved by etappen lines; the field telegraph being thus free for work at the front.

The field telegraph detachments kept up communication with all portions of the armies on the march, using the lines of the country where available, and where not so available, building light temporary lines to be replaced later on by the etappen detachments. General von Chauvin says: "The line was laid quickest when the telegraph detachments accompanied the advanced guards, very often these even preceded the most advanced troops, accompanied by special covering parties. In such cases it happened more than once that the telegraph stations were actually exposed to fire, and sometimes had to retire before the advancing foe."

At sieges the invested places were immediately surrounded by a network of lines; thus at Paris a complete system connected the besiegers' posts, having its telegraphic centre at Versailles.

The telegraph was used for the defence of positions, as at Lisaine by the XIVth Army Corps, where the most important points of the position were connected to headquarters, and the orders and reports transmitted by wire contributed in no small degree to the victory of the defenders.

According to Von Chauvin, it had been clearly recognized in Germany, before the war, that the telegraph could be used on the battlefield itself; but there were no telegraph troops who had been trained in peace-time for the purpose, and it was only the want of such prevented the tactical use of telegraphs on many occasions when they would have been of value.

Even now Germany has no telegraph corps in peace-time, though the want is recognized, and I believe steps will shortly be taken to meet the deficiency.

On this point Von Chauvin says: "The experiences of the Franco-German War have distinctly shown the necessity of a telegraph corps, but the question of expense limits its size to what is only necessary, that is to say, it must only be sufficiently large to enable to be trained in peace the Officers and men required for the field and etappen telegraph detachments in war."

England has got over this difficulty of expense by utilizing a military telegraph division in maintaining a portion of the State telegraphs during peace, thus throwing no expense whatever on the State, and at the same time training a large body of Officers and men.

Ashantee Expedition.

The next occasion we see telegraphs in the field was in Ashantee. A detachment of Royal Engineers from the companies employed in maintaining State telegraphs was sent out under Lieutenant Jekyll. They put up a line 110 miles in length, to a point 20 miles beyond the Prah.

French Regulations.

In 1876 the French took up the question of field and outpost telegraphs, and regulations for field and outpost telegraph sections were

introduced into their Army. A detachment, consisting of 18 mounted telegraphists, 12 of whom were to be Officers, was also arranged for each cavalry division.

Sounders were to be the instruments used.

The duties as laid down were—

1. To connect the Army headquarters with the staff and divisional headquarters, and to extend this connection to the working units.
2. To connect the various headquarters of Army Corps with those of bodies of troops told off for special services, as reconnaissances, outposts, &c.
3. To remove or destroy existing telegraph lines.

Russo-Turkish War, 1877.

Russia followed the example of France, and also organized cavalry telegraph detachments for outpost work.

In the Russo-Turkish War of 1877 the Turks had no military telegraph or signalling corps. Certain existing lines were worked, and extended under civilian employés; but no tactical use was made of them.

On the other hand the Russians, with a purely military organization, employed them freely, and the success of one of their most brilliant operations was secured by an intelligent use of the telegraph.

In October, 1877, the Russians, advancing from the Caucasus under the Grand Duke Michael, decided to cut off the Turks from Kars and Erzeroum. This was to be accomplished by a turning movement, to cut the lines of communication of Muktar Pasha (who commanded the Turks), while he was to be attacked in front by the rest of the Russian Army.

All depended on co-operation at the right moment.

General Lazareff was detached with 27 battalions, 40 guns, and 6 regiments of cavalry, to execute the flank march of 40 miles. On the 13th he had thrown himself across Muktar Pasha's communications, but was threatened by a superior force despatched under Reshid Pasha against him. Lazareff had, however, been accompanied by a field telegraph, and wired the state of affairs to the Grand Duke. The despatch was received by the latter at 3 A.M. on the 14th. On the 17th the Turks were simultaneously attacked on both sides and crushed.

The telegraph was used during the march for reconnaissances, and also during the battle itself. It was guarded by Cossacks, and was only broken down for two hours during the entire operation.

The fate of the campaign in Armenia had hung on a single wire.

Zulu War.

The Zulu campaign in 1879 was the first expedition in which the mounted telegraph troop of our Army took part. After Isandhlwana Lord Chelmsford asked for a field telegraph; up to that he had none. C Troop went out under the command of Major Hamilton, R.E.,

but with only 30 miles of wire and cable. A branch line from the existing colonial lines was run from Ladysmith to Dundee and Landsman's Drift; but the material was then run out, and further operations were carried out by the C troop and other regimental signallers with complete success. Another detachment landed at Port Durnford soon after the battle of Ulundi, with 100 more miles of wire. A line was run from that point to within 10 miles of Ulundi.

Later on, when some troops were stationed in the Transvaal, a line was run to connect Wakkerstroom and Utrecht.

Transvaal War.

In 1881 a combined section (under the new organization) from the Postal Telegraph R.E. Companies, and from C Troop, was made up and despatched to Natal under Lieutenant Bagnold. They arrived at Newcastle towards the end of May, and soon afterwards laid a line to Pretoria, which proved of great value during the negotiations which preceded the Convention with the Boers.

Egyptian Campaign of 1882.

In 1882 the field telegraph section did not arrive at Ismaïlia until a week after the whole of the troops were in Egypt and engagements had been fought. Before their arrival Lieutenant-Colonel Salmond, R.E., had to make the best he could of what he found in the country in the way of lines and operators. On the arrival of Sir Arthur Mackworth, R.E., with the sections, their first task was to repair the existing lines as quickly as possible, and then to push on to the front.

One Officer and a small party of mounted telegraphers were attached to the cavalry division to accompany any raids or reconnaissances.

On the 8th September Sir A. Mackworth with a detachment accompanied Sir Gerald Graham's reconnaissance, paying out $3\frac{1}{2}$ miles of cable. Previous to retiring before the enemy, who appeared in considerable force, two messages were sent through to Kassassin. The cable was left on the ground, but most of it recovered afterwards. The instruments used were Theilers, or vibrating sounders with telephones.

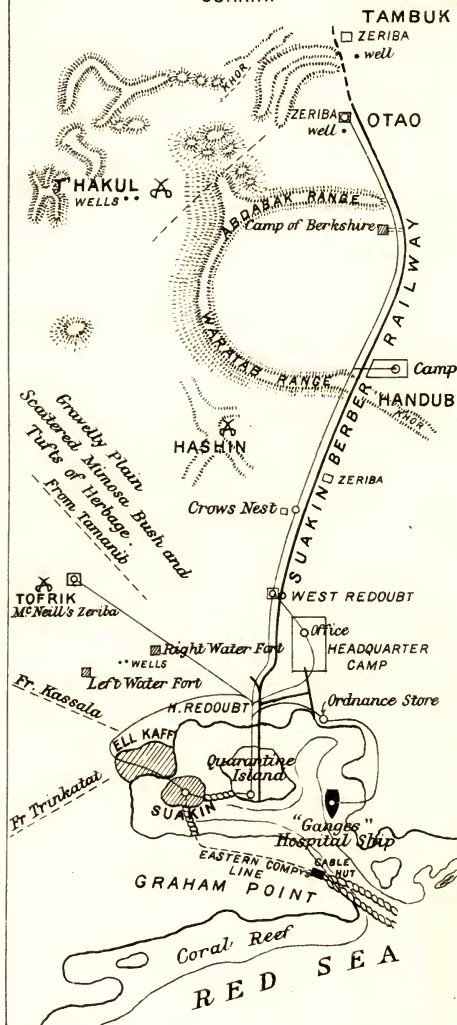
On the 9th the enemy attacked from Tel-el-Kebir, and the camp of the telegraph was for some minutes exposed to a hot shell fire. During this a party of telegraphers were steadily working in a tent round which the shells were bursting, and which was hit more than once by the fragments. Several messages were sent with coolness and precision, among others one which brought up the Brigade of Guards and the Headquarters Staff.

At 7 P.M. on the 12th a cable line was commenced to accompany the advance on Tel-el-Kebir, arrangements were made to follow it up by an overhead wire if necessary, and also for repairing the railway lines towards Tel-el-Kebir.

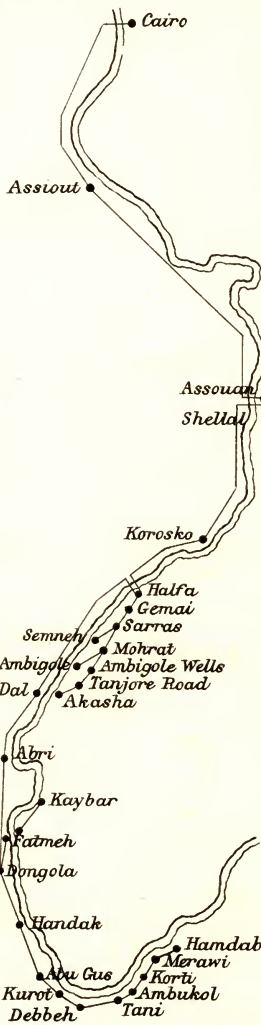
On arriving at a point a mile in front of the outposts, a halt was made to await the infantry.

MILITARY TELEGRAPHS 1885.

SUAKIN.

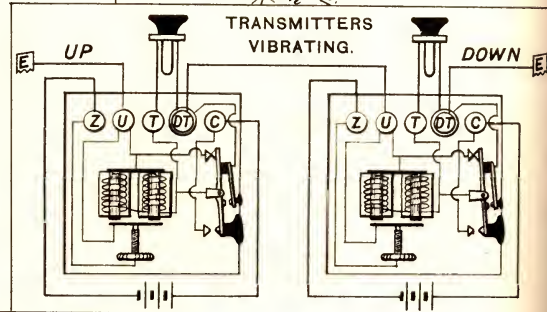


MILITARY TELEGRAPHS NILE EXPEDITION



| TABLE OF DISTANCES FROM CAIRO. | DISTANCES BETWEEN STATIONS. | DISTANCES FROM CAIRO. |
|-------------------------------------|-----------------------------|-----------------------|
| ASSIOUT | 240 | 240 |
| ASSOUAN | 380 | 620 |
| SHELLAL | 6 | 626 |
| KOROSKO (FROM ASSOUAN) ... | 110 | 730 |
| WADY HALFA | 100 | 830 |
| GEMAI | 16 | 846 |
| SARRAS | 17 | 863 |
| SEMNEH | 9 | 872 |
| MOHRAT (FROM SARRAS) ... | 20 | 893 |
| AMBIGOLE | 8 1/2 | 901 1/2 |
| AMBIGOLE WELLS (FROM MOHRAT) | 12 | 895 |
| TANJORE ROAD | 8 | 903 |
| AKASHA | 10 | 913 |
| DAL (FROM HALFA) | 100 | 990 |
| ABRI | 25 | 955 |
| ABU FATMEH | 84 | 1086 |
| KAYBAR | 24 | |
| DONGOLA (FROM FATMEH) ... | 37 | 1076 |
| HANDAK | 50 | 1126 |
| ABU GUS | 33 | 1159 |
| KUROT | 13 | 1172 |
| DEBBEH | 4 | 1176 |
| TANI | 40 | 1216 |
| AMSUKOL | 5 | 1220 |
| KORTI | 4 | 1224 |
| MERAWI | 30 | 1284 |
| HAMDAB | 20 | 1274 |

FIELD TELEGRAPH IN BECHUANALAND 1884-5.



Note. Telegraph line shown thus ———
" office " " " ○

Just at midnight Lord Wolseley came up, and sent a message through to Sir H. McPherson. At 2 A.M. another move forward was made.

During the action which ensued, the telegraph was present throughout, and came under fire.

Immediately afterwards it was ordered to join up to the railway station 3 miles off. This was accomplished, and communication established with Kassassin by 8 A.M., the 3 miles of cable being laid in half an hour.

At 8.30 A.M. Lord Wolseley's messages to the Queen and War Minister were despatched. At 9.15 Her Majesty's reply was received.

The instrument used was the vibrating sounder and telephone.

A telegraph detachment now proceeded to Cairo with the foremost troops, and without delay put the whole telegraph system of the country in working order.

The field telegraph was used to a large extent in the three expeditions which took place during 1884-85. The lines, however, were all etappen lines, except in one instance, when a wire for a tactical purpose was run in the Eastern Soudan.

Nile Expedition, 1884-85.

On the Nile the great difficulties to contend against were the unparalleled length of the line of communication, and the restricted amount of transport. We must all regret that it was not practicable to send a line across the Bayuda Desert with Sir Herbert Stewart's column, such an exploit would have been unequalled in the annals of the field telegraph.

One most valuable point as regards the feature of outpost telegraphy was brought out by the satisfactory working of bare wire laid on the ground and joined up with vibrating sounders. I hope that some of the Officers who were on the Nile will give us some further account of what was done.

Bechuanaland Expedition.

In Bechuanaland a line of some 350 miles in length was run to keep the headquarters in communication with the Colonial telegraph system and with the various intermediate stations. The working of this line was admirable. At one time, for a period of nineteen days there was not a single fault or breakdown of any description.

Expedition to Suakin.

In February, 1885, a field telegraph section of two Officers and sixty non-commissioned officers and men was organized to accompany Sir Gerald Graham's force to Suakin. It landed at this place on the 7th March.

Light lines were immediately erected from the headquarter camp to Suakin and Quarantine Island, also other short lines to connect the various departmental depôts in Quarantine Island.

On the 21st March a light overhead line was run out into the

desert from H Redoubt as far as it was safe to do so. This was to facilitate the operations arranged for the following day during the advance of Sir John McNeill towards Tamai.

On the 22nd a telegraph detachment under Lieutenant Lindsay, R.E., accompanied Sir John McNeill's force, and, marching with one of the squares, laid out cable from the end of the line erected the previous day.

$5\frac{3}{4}$ miles had been paid out when the halt was ordered, and the General wired back his reasons for not going on to the place previously arranged upon for a zareba. This was about 11 A.M. to 12 noon. One or two messages passed between him and the Chief of the Staff.

Zarebas were now commenced; at 1 P.M. the telegraph instrument was moved from the open into one of them, and stood on some empty ammunition boxes.

At 1.40 P.M. Major Turner, Director of Telegraphs, wired to the C.R.E.: "We have kept up communication so far with perfect success."

At about 2.45 the enemy attacked: the telegraph instrument got knocked over by the rush of men into the zareba; but, when the worst of the storm had blown over, a new instrument was at once joined up. Meanwhile, the telegraph detachment had been assisting to defend the zareba into which, at one time, some Arabs had actually penetrated.

At 3.25 P.M. the General sent his despatch to the Chief of the Staff by wire. This message allayed the great anxiety felt in camp, and stopped reinforcements coming out.

Two press messages, one for the "Times," and the other for the "Daily News," were immediately handed in by the special correspondents. While sending these, the clerk in charge had several times to leave his instrument to assist in the defence, as it appeared from time to time that the enemy would renew the assault.

During the afternoon between twenty and thirty messages were sent and received, several passing between General McNeill and the headquarters.

At 7 P.M. the line was cut, and signallers took up the running with lamps to the Right Water Fort.

After this the duty of the telegraph section was to keep up and extend the communication between headquarters and advanced brigades, and also orders were given to work the railway traffic.

Another section landed on the 21st April.

The telegraph was now only pushed to the front so as to keep pace with the railway, and the furthest point reached was Otao, about 20 miles from Suakin. The great difficulties we had to contend against in the maintenance were the climate, the Hadendoahs, and the camels. The first affected the men to a serious extent, especially as the work at the outset, and indeed throughout, was laborious and carried on without intermission during the day under a tropical sun. Loss of physical energy, when energy is everything as in maintaining telegraphs, is a matter the serious nature of which can only be appre-

ciated by those who have had to force work out of men in a bad climate when the excitement is over and reaction has set in.

The Hadendoahs were most active in destroying the line by night, and caused endless work and annoyance. But they hardly did more damage than the camels. At Suakin, the force being concentrated, a huge number of animals were constantly crossing and re-crossing the line of the telegraph line, and treating the latter with the greatest disrespect.

When the telegraph was broken down the signallers took up the running, but, for reasons which I will touch upon later on, signalling, though a valuable assistance, did not adequately fill the gap.

The affair at To Frik was the first occasion on record (as far as I know) of the telegraph having been in the centre of a fight when it had come to the cold steel period, and enemy were lying where they fell within 2 or 3 yards of the instrument.

The presence of the telegraph on this occasion, I believe, was due to the representations of Colonel Edwards, C.R.E.

Had the expedition been persevered in, this telegraph would have borne a very important part, and the personnel would have required very large reinforcements. How this would have been done is not very clear, as the three simultaneous expeditions had drained the home resources as regards men, and not only that, but a certain strain was felt by the State telegraphs, which had despatched so many Royal Engineers to the seats of war.

It is to be regretted that the absence of proper cable at first prevented light lines from having been run to the extreme points reached by our troops. The cable used at To Frik was outpost cable, totally unfit for the purpose of such a length of line, as being far too delicate and easily broken. The marvel is, it stood as long as it did.

It is the departments of an army who use the wires to the greatest extent; on one day, at Quarantine Island, 800 messages, the majority to or from the departmental offices, passed through two instruments. This beats most records on key speed circuits in the busiest offices in England, and requires the very best clerks to deal with it.

Indian Telegraphs.

In India the telegraph is on a different footing. There is a small nucleus of sappers and miners who form a military telegraph detachment. But on all expeditions they are largely supplemented by the civilian State telegraph employés.

Field telegraphs in the shape of etappen lines have been used in all the expeditions which have taken place of late years in that country. But we have no record of their tactical employment.

Uses of the Telegraph in the Field.

It is scarcely necessary for me, in these advanced days of military science, to dwell upon the uses of the telegraph for war. As I have stated before, it minimizes to the utmost the factors of time and space in dealing with questions of communication; and how far it is

desirable to do this, rests with those responsible for the conduct of an expedition.

All we of the telegraph can do is to provide the messenger that exclaims—

“ I fly with the lightning of Heaven,
I travel unseen and unread ;
A word, and the impulse is given,
A touch, and the message is sped.”

Rapidity is the soul of war. “That which is done quickly is done twice,” is a proposition never so certain of demonstration as in the active operations of war.

It has now been clearly established in every army that no extended operations can be carried on without the telegraph, and before long it will be equally recognized that its presence is as necessary to every part of an army as nerves are to a living body.

Some of the ways in which this messenger can be usefully employed may be enumerated as follows :—

- Keeping up communication with the base.
- Regulating the supplies to troops in the field.
- Arranging for reinforcements.
- Arranging for disposal of sick.
- Arranging for disposal of prisoners.
- Keeping up communication between headquarters of armies, Army Corps, Divisions, brigades, &c.
- Controlling the march of columns for strategic purposes.
- Rendering concerted action more certain.
- Regulating railway traffic.
- Obtaining intelligence from the front.
- Concentrating troops for attack or defence.
- Giving orders and necessary reports on the field of battle.
- Investing fortresses.
- Concentrating to repel sorties or make assaults.
- Regulating combined artillery action.
- Defence of fortresses, positions, &c.
- Defence of coasts.

And in many other ways which will easily suggest themselves.

I would direct your notice to a very valuable paper read by Major (now Major-General) Webber, R.E., before this Institution on the 31st March, 1879, and entitled “Orders in the Field, and the Means of Communicating them.”¹ The portion of the paper relating to telegraphs would be read with advantage by all those interested in the subject.

One great feature in the use of the telegraph as a channel for orders is, that it enables a commander to qualify, rescind, or enlarge an original order at once, and without risk of misconception. Those who have much to do with giving orders for the execution of important work know the folly of giving verbal orders; the man you give

¹ See Journal, vol. xxiii, page 631, *et seq.*

it to, in nine cases out of ten, is only partially listening to what you are saying, and, even if he does listen, frequently does not grasp the full meaning. No practical man gives verbal orders.

But with a written order it very frequently arises that a change in the order appears desirable after the messenger has gone. The telegraph gets over all these difficulties.

That it has a great tactical future before it cannot be doubted. Von Chauvin says: "There seems to be no doubt, both from our own experience, as well as from the experience of others in war, that the main point is to improve and increase what may be called the use of the telegraph for tactical purposes."

Outpost Telegraphs.

The necessity for having an outpost organization is recognized in England inasmuch as the equipment has been prepared; but here it stops, no steps have as yet been taken to accustom Officers and men of infantry and cavalry regiments to work with it.

It would be impossible to lay down hard and fast lines for its use, just as it is impossible to lay down hard and fast rules for outposts themselves. All that could be done would be to put a valuable aid to communication into the hands of regiments, and the Officers commanding would soon find out how to use them to best effect.

The proposition I put forward is to give all regiments, cavalry and infantry, a small telegraph equipment which would be at the disposal of the Commanding Officer for such operations as he thought fit, and the combined regimental telegraph would be at the disposal of the Officer commanding the brigade or Division. To work these regimental telegraphs, men of the same high proficiency as are required for army telegraphs would not be necessary, but it would be desirable that they should be trained in the same school.

Signalling is not always applicable for outpost work. Its success depends on weather and the physical features of the country, and its action is readily detected by an enemy.

It is sometimes asked, "Can the telegraph be used in the line of outposts?" The answer I would give is—"Anything that is worth doing can be done."

The opposing armies in Paraguay frequently used it; but it is true that the slowness of their movements facilitated its operation.

That it can be used to advantage in the fighting line has been frequently illustrated. In the American War, on the 27th June, 1862, a telegraphist named Burnell established a station 300 feet behind the fighting line of General Porter at Gainey's Mill, and worked without interruption to the reserves and to General McClellan. Burnell was for hours exposed to the enemy's bullets, only protected by a tree. He took the messages on a sounder.

In a reconnaissance of the town of Farnington a troop of cavalry under a Captain Smith set up, under a telegraphist called Parsons, about 4 miles of wire. The troop was attacked and partially captured, Parsons telegraphed under fire, while slowly retreating with

the remnant of the troop, by connecting up his instrument from time to time.

Signalling.

As it now exists the signalling is a distinct organization from the army telegraphs in the British Army. The signalling service has two principal rôles to play. The first comprises all communication in the field for minor purposes. The second in connection with army telegraphs, which it has to supplement, and under certain circumstances to replace.

Before the telegraph is laid signalling does the work ; if the wires are broken down it bridges the fault till repaired ; it forms branches and prolongations when it is not considered necessary to run lines for the purpose ; and in many other ways it is an auxiliary.

Signalling accordingly might be split up into two distinct branches :

1. Regimental signallers trained as at present.
2. Signallers to be part and parcel of the telegraph battalion.

The present signallers, that is, the non-commissioned officers and men, though they are as well trained and as expert with their flags and mirrors as could be desired, are nevertheless not possessed of sufficient education to enable them to work the traffic on a busy telegraph circuit, or in conjunction with a telegraph office.

To deal with the heavy traffic of a telegraph office requires a man who is not only a good manipulator, but who has had a fair education, and a long training in a post office. No one else can do it satisfactorily.

This is especially necessary for war, because the telegraphic traffic is greater in some respects than in civil life, and in the midst of disturbing elements a man is required who, being perfectly at home at his work, is not liable to lose his head.

Signalling from its nature can never keep pace with the telegraphs, but also, as it now exists, it cannot, in the event of telegraph lines breaking down or being in need of extension, take up the running as it should do. The lines become clogged with messages, the signaller from want of practice in telegraphic traffic and from want of higher education is unable to deal with it.

The telegraph clerks now used in the field are among the best that the Post Office can produce, and are men of very considerable education.

There is now a system by which Post Office Volunteers can join the colours for service in the field, and very valuable service they can render as telegraphists ; this I can personally vouch for. The same system, I believe, is to be extended for the signalling service, but the men should be telegraph clerks.

A telegraph clerk can pick up signalling very rapidly.

Seeing the disadvantages of two services which have to work together being under distinct organization and commands, my proposal would be that the signalling service of the Army should be attached to the telegraph battalion, and the non-commissioned officers and men

should be trained telegraphists; that the Officers, artillery, cavalry, and infantry, should be trained in telegraphy as well as in signalling.

The Americans found in their civil war that they were obliged to amalgamate the Signal and Telegraph Corps, and I think we would find the same in any prolonged operations.

Telegraphs for Artillery.

I would bring to the notice of artillery Officers a proposition for using the field telegraph for artillery tactics.

The question of concentrating artillery fire on particular points during an action has often been discussed. It may be desirable to concentrate the fire of a very large number of guns on some one object. The position may be such that these guns, occupying a very extended front, render unity of action difficult. Would not the telegraph sometimes be of service on such an occasion to concentrate and control the fire without concentrating the guns?

It might also be used for range-finding, as is done in Germany.

Organization.

In some foreign armies telegraphs are classed as—

Field telegraphs.

Etappen „

State „

The field telegraph comprises all advanced and temporary lines, whether for tactical purposes or for connecting various headquarters.

Etappen lines are for connecting the headquarters with the base, and the various points for concentration, or advanced bases on the lines of communication.

State telegraphs are heavy permanent lines for carrying, not only the war traffic, but also all the ordinary traffic of a country.

Then the etappen are the connecting links between the field and the State telegraphs.

In our expeditions we have never, except in Egypt, as yet had to deal with State telegraphs, and in fact what we have done comes under the heading of field telegraphy, as above.

To the three classes mentioned I propose for consideration a fourth, *i.e.*, regimental telegraphs. These would no doubt be a branch of field telegraphs, but would be on a different footing. All regiments, cavalry and infantry, might be provided with a small telegraph equipment, to be used for outpost purposes and for connecting themselves with headquarters in camp. Whether the instruments should be telephones or not is a matter of detail or of experiment.

As regards intercommunication in camp, it would be a simple matter to organize a telephone exchange at the headquarters in many large camps an hour after it was pitched, each regiment to lay and maintain its own line of cable. The number of orderlies saved would far more than compensate for any expense.

Regimental telegraphers, though they should be trained by the

telegraph battalion, would not be under the Director of Telegraphs in the field, whose province is only with the lines for army communication.

Present Organization in the British Army.

As most of you are aware, there is now in our Army a telegraph battalion of two divisions. All the telegraph service in the field is performed by them.

In peace-time, one division with wagons and horses is stationed at Aldershot, and trains Officers and men for field telegraph.

The other division maintains, under the Engineer-in-Chief to the General Post Office, all the State telegraphs in the south of England and Channel Islands.

For war purposes, sections of about fifty men are formed, a certain proportion from each division.

The system has shown itself an admirable one, and the most economical a State could maintain. But in matters of this kind, we must look forward to what is likely to be demanded in the future, and not measure our requirements by the past alone.

The uses made of the telegraph for war increase at a startling rate, and will increase as its powers become more recognized. In years to come, it will be considered as great an anomaly to send a body of troops on any detached duty in the field without its connecting telegraph line, as it would be to send a man who was dumb as a Member to the House of Commons.

What we have to consider, then, is how to extend the training which is necessary for signallers and telegraphers in every branch of the Service.

It is evident that no extra strain should ever be put on the State telegraphs in England by withdrawing too great a proportion of men employed on them for foreign service; but with the present strength of the battalion this is inevitable. The only way to meet the difficulty is to increase to a very considerable extent the Officers and men under training.

Training.

Though the duties in the field may look simple, it nevertheless requires a long and careful technical training to give a man the requisite qualities.

A telegraph lineman in war or peace has far more responsibilities, and has to exercise his judgment and forethought to a far greater degree than falls to the lot of many an Officer in Her Majesty's Service. To train a man to the required point can only be done by a combination of instruction in State and in Field Telegraphy; and to train non-commissioned officers for the positions of great responsibility which may fall to them, can only be done in schools such as the State telegraphs, where responsibility and emergency are their daily portions. Results justify this opinion.

And I may here remark that none but non-commissioned officers of superior education should be chosen.

The maintenance of telegraphs admits of no hesitation, no mistakes, and no fear of responsibility.

As regards the training of Officers, a deep scientific knowledge of electricity is not necessary, but it is necessary that they should know enough to be able to follow and utilize for war purposes the improvements that are daily being brought out in the art of telegraphy, and every Officer should be able to teach his men in all their duties, and in addition to this, should be accustomed to deal with large questions of organization.

In the field, a good organization for working what is a very complex piece of machinery is a *sine quâ non*.

Though the telegraphs have had such great success in our Army, and the organization (thanks to our predecessors in the work) is undoubtedly the best in any European army, and is recognized as such, I would point out the danger of resting on our oars, satisfied with past successes. What we have hitherto done in war has only been the simplest kind of field telegraph work. We have only run single etappen lines from the base to the front; these have been only single lines of communication, and no complicated problems for the telegraph. It will be different if at any time we take part in an expedition into a European country, where the advance may be by several main roads, and cross communications and numerous branches necessary; when the telegraphs of the country will have to be taken over, and worked, not for military purposes alone, but also for the civil government of the country. Instruments of a far more complicated nature than those for field use would become necessary, and such an organization indispensable, that could only be worked by Officers and men who had undergone a long training in peace. Our present organization has been equal to what has as yet been required of it; but to provide a trained personnel for a more extended field of action, such as I have sketched, would be beyond what it could do without unduly straining the State telegraphs at home.

In conclusion, I would say, that whatever organizations may exist, our duty as telegraph engineers is to be ready at all points to show that the motto for the telegraph is, "Ubique."

Herr von FISCHER TREUENFELD: Major Beresford has mentioned my name in such flattering terms that I am hardly in a position to know how to thank him for such distinction. There is one thing I can say with certainty, viz., that every telegraph Officer, not only English, but of any army, must feel very much indebted to the lecturer for having brought before this meeting the subject of strategical and tactical telegraphy. We all know very well that not many years ago, say ten or twelve at the utmost, very little was known about military telegraphy. The general knowledge as to the formation, the organization, the personnel, and the matériel of military telegraphs was indeed very limited. Thanks to the literature of late years and to the valuable papers read by various Officers, and especially English, this early condition of semi-ignorance has passed away, and we are now very well acquainted with the formation, the organization, the personnel, and the matériel used by other armies in Europe and elsewhere. But I would ask, have we an equally good knowledge relating to the sphere of action which a military telegraph ought to have in the army? I mean as regards participating in the operations of war. As to these matters there is an immense difference of opinion, and I

maintain that we are very far from having clear ideas on these points, and therefore think that it has been very timely and opportune of Major Beresford to bring this subject before the meeting. If we take a glance over the various organizations of military telegraphy, we shall find that some countries have an organization which only allows telegraphic connection from the base of operations with the headquarters of armies, not even including the headquarters of army corps. There are others which have such an organization that they extend their telegraphic communication beyond the divisions and brigades to the very outposts, or even, as for instance, the French and the Russians, behind the outposts in the form of cavalry telegraphs for reconnoitring purposes. Major Beresford states that in the year 1876 the French took up the question of field and outpost telegraphs, and regulations for field and outpost telegraph sections were introduced into their Army. The duties as laid down were—"First: to connect the army headquarters with the staff and divisional headquarters, and to extend this connection to the working units. Secondly: to connect the various headquarters of army corps with those of bodies of troops told off for special services as reconnaissance, outposts, &c." This is an organization which goes very far in tactical telegraphy, but if we compare another European Army, equally anxious to arrive at perfection, namely, the German, we find that quite different opinions are held. There the official *règlement* prescribes the task of field telegraphy, to maintain an uninterrupted telegraphic communication from the base of operation, to the great headquarters, and thence to the headquarters of the armies in the field, the telegraph not extending to the army corps, but to such corps which are operating independently. The connection between an army headquarters and an army corps is only admitted under exceptional and favourable circumstances. But here stops the programme of German field telegraphy! I should like to impress still more upon you this difference of opinion with regard to strategical and tactical use of the telegraph by a few figures. First, allow me to draw your attention to the difference of formation with respect to the number of telegraphic sections for each army corps. Of course the section might be of different strengths, say fifty, eighty, or more men, but let us take the section as the unit in this present general comparison. There are some armies in Europe which have no telegraphic sections at all--Turkey, Portugal, and Greece. I believe Portugal is going to have an organization, because they have had a Director of Military Telegraphs for several years. Then, and this is a striking thing, comes Germany, which shows that in Germany the opinion in favour of the extensive use of telegraphs is very limited, that is to say, the telegraph is concentrated within the sphere of the principal headquarters and not beyond them. In the Franco-German War the Germans had twelve telegraph sections for fifteen army corps, equal to four sections to five army corps. After the war this low proportion, through an increase of army corps without a corresponding increase of telegraphic sections, became still smaller, and the German Army has now only four telegraph sections to six army corps. We have then Belgium, Holland, Sweden, and Spain having each one telegraph section for one army corps. Then comes France, which in accordance with the new organization of 1884, possesses field sections, telegraph parks, *etappen* sections, and railway telegraph sections, and taking all these together they have two telegraph sections for one army corps, or nearly so. Then comes Switzerland, with two telegraph sections for one army corps; then Italy with nine telegraph sections each of one hundred and nine men, and which are so divided that there are two sections for one army corps; then Russia has three telegraph sections for one army corps; Austria has fifty-two telegraph sections in the proportion of three sections for one army corps; and last, or rather foremost, comes the English Telegraph Battalion, which has eight sections for two army corps, or in the proportion of four sections to one army corps. These numbers show that there is certainly a great variety of opinion with regard to organization and with respect to strategical and tactical co-operation of the field telegraph. There is another point upon which, with your kind permission, I would bring a few figures before you, in order to show the very vast difference in the opinion of army telegraph authorities, namely, the proportion between insulated cable and naked wire that is prescribed by the army equipment and carried by

each field telegraph section. We may say that the naked wire erected on poles represents the strategical element, because that is a line which can only be slowly erected, and it requires more transport, and therefore is kept more at the rear than the light cable which requires less transport, and can be more readily led out towards the front. I should, therefore, say that on the other hand the field cable represents the tactical element of an army telegraph system. A comparison of the proportions carried by each army of these two would give an idea of the views of the different armies with regard to the strategical or tactical sphere of action for their military telegraphs. Commencing again from the lowest proportion, we find that Sweden uses very little cable, only about one-sixth cable to one of naked wire. Then Denmark has about the same proportion—one-fifth of insulated cable to one of naked wire. I would say that these armies do not use cable because they dislike to use any articles of war which they cannot manufacture in their own country, so that strictly speaking they are not opposed to the use of cable except for that reason. Then there is Russia, whose use of cable in respect to naked wire is as one-fourth to one; of course Russia will always have to rely more upon naked wire than upon cables, owing to the enormous distances they have to cover. Then comes Germany, in which the use of field cable is also limited. The proportion between cable and naked wire in Germany is with regard to the field sections 0·7 to 1, but of course in the etappe telegraph sections the proportion is very low, namely, 0·1 to 1. In Italy the proportion is 0·7 to 1. In England the proportion is 0·8 of cable to 1 of aerial line. In Holland it is 1·3 of cable to 1 of aerial line; in Austria 2·1 of cable to 1 of aerial line. Then we come to France, which after the Franco-German War has given the preference to cable. Thus after the organization of 1874 the French Army possessed 19 field telegraph and 14 etappe sections. All these sections had five times as much cable as aerial wire, so that the proportion was 5 to 1. According to the new organization of the 16th March, 1884, the proportion between cable and aerial wire is for the field sections 3·6 to 1, for the telegraph parks 4·6 to 1, and for the reserve parks 8·3 of cable to 1 of aerial wire. So you see that France has a far greater abundance of cable than Germany and England. Then comes Spain, which has no aerial wire at all; the Spanish telegraphs being entirely based on cable communication. All cable and other materials being packed and carried on mule-back, the Spanish Army possesses the most movable field telegraph, well adapted for tactical operations. The above figures show that a vast difference of opinion exists with regard to the question under discussion, and compared with former years those figures prove the importance which cable-lines have attained, and that their rôle is becoming more and more extended. As the field cable represents the tactical element of the army telegraph, and supposing it is wanted to increase the sphere of action of an army telegraph towards the front, the principal thing to be done for attaining such an end is, to improve the field cable; that is to say, to make such cable stronger and lighter. It is the question of transport, and that alone, which puts a limit to its being brought to the front in a great war, as for instance with the English field cable, which the late Director of Austrian Field Telegraphs, Ritter von Klar, and I devised in 1875, for the Austrian Army, and which has now been adopted by nearly all European Armies, it would require at least ten cable-wagons and sixty to seventy horses to connect one single advancing army headquarters with three army corps, not including any connections to any division. The weight of the field cable being the principal hindrance in advancing telegraphic communication towards the front, I recommended fourteen months ago to improve the present field cable, and Messrs. Siemens Bros. and Co., of London, have constructed since then a number of such cables, some of which were submitted to the Royal Engineers many months ago. I have now the pleasure of laying before you a small length of such cable, which I believe will give very great advantages to field telegraphy, because the conditions of that cable are much more favourable to transport and strength than those of any cable hitherto used. The cable now in use in the English Army, which is called No. D. 5, has a diameter of 6 millimetres, whereas the new cable has a diameter of less than 4 millimetres; the weight of the old cable is 170 lbs. per statute mile, as against 105 lbs. for the new cable of the same length. The breaking strain of the old cable, the D. 5, is 250 lbs., and of the new cable 500 lbs., so that the old cable is 62 per

cent. heavier than the new one, and, besides, the latter has double the breaking strain. The result being that 8 miles of the new cable is only equal in weight to 5 miles of D. 5, and that each cable-wagon would thus carry 8 instead of 5 miles of field cable. That is such an improvement that by the use of the new cable it will, I think, be possible to push forward the operations of telegraph work still further than has been done at present. But there is one principal thing which must not be forgotten in considering questions relating to strategical and tactical telegraphy, that is, whether we are dealing with advancing warfare, or with warfare in position. Now with regard to warfare in position, every telegraph Officer agrees to-day that telegraphic communication must be extended beyond the headquarters of army corps, divisions, and brigades, to the very outposts and advanced detachments of observation. There no longer exists, therefore, any difference of opinion as to the use of the telegraph, electrical as well as visual, in warfare of position, but it becomes quite another consideration with a rapidly advancing army, that is, when we treat the case of "advancing warfare." The vast difference of opinion to which I have alluded refers principally to this latter form of warfare; hence the discussion of a paper on "The Use of the Field Telegraph in War" must necessarily direct itself to the question, how far telegraphic communication during the operations of advancing warfare can advantageously be carried out, and, therefore, ought to be adopted? In my opinion a well-planned field telegraph organization ought to provide all the elements, "personnel and matériel," to maintain not only daily uninterrupted communication between the base of operations and the advancing headquarters of the armies and army corps, but also in special cases of necessity and on favourable occasions, to extend their communications towards important points near or at the front, especially at those moments when decisive battles are expected. But a well-planned field telegraph must also possess all the necessary elements to enable it to be changed at once from its strategical work, consisting in the connection of headquarters of an advancing army, to its tactical work, spreading out the telegraphic communications to the smaller bodies of the army, and even to the outposts and battle-fields, should the form of warfare suddenly change from that of advancing into that of position. That the field telegraph can be brought to the front and be used there with advantage during the outset, was proved over again in 1882, by the splendid action of Sir Arthur Mackworth before, during, and after the battle of Tel-el-Kebir, and I regret, with Major Beresford, that during the Nile expedition of 1884-85, when the decisive battles were fought north of Khartoum, the most advanced field telegraphic station at Hamdab was over a couple of hundred miles at the rear of General Sir Herbert Stewart's column advancing on Metammeh. In spite of this unfavourable fact, which tends somewhat against the doctrines of advancing telegraphic communication, and participating in tactical operations, I nevertheless maintain the opinion, also favoured by such experienced telegraph Officers as Colonels Hamilton, Armstrong, Jelf, and others, who in this very hall, on the 15th of February, 1884, opined that "the telegraph should be able to follow advancing columns and keep uninterrupted communication with them." Such achievements will be greatly assisted by the method of paying out bare wire, to be supported later on by field posts, and using Captain Cardew's vibrating sounder, or by adopting any such field cable as I have the pleasure to lay before you, by which not only the strength of the line is doubled, but the proportion of cable carried by each wagon is increased from 5 to 8 miles. The adoption of such technical improvements is required in order to extend the sphere of action of the field telegraph during "advancing warfare."

Lieutenant-Colonel JELF, R.E.: As there seems to be a disinclination on the part of people who have more right to speak than myself to give their views, I may perhaps be allowed to justify the old adage "that fools rush in where angels fear to tread." In doing so it may perhaps be found of interest if I give some little account of the line that we laid, in connection with Sir Charles Warren's late expedition, from Barkly up to Mafeking and as far as Molopolole, in South Africa. This telegraph was laid in a country which absolutely had no telegraphs at all; we found a perfectly clear space before us, but we had to take every single article of equipment from England, 7,000 miles by sea, and another 1,000 miles by land, before we arrived at our point of departure. Sir Charles Warren's great idea was to have the

telegraph with him, at all events as soon as he moved, and if possible (in places where it was safe, and as long as it was safe) actually in advance of him, that is to say, with the most advanced party, a sphere of operation which I think has been mentioned to-day as one of the possible rôles of the telegraph in future. One of the great difficulties that we had to contend with, looking at the magnitude of our plant, was the very small number of men we had to deal with it. We only had one Officer and forty-five men of the Royal Engineers for the purpose of constructing and working this telegraph, a distance of 220 miles from Barkly to Mafeking, the latter being the point to which Sir Charles Warren was bound to penetrate with all possible despatch. We were met at once by difficulties, political as well as strategical. We knew that very many people in Griqualand West (which properly speaking is part of the Cape Colony) were as disaffected as those in any portion of the South African Republic, though it was generally supposed that the South African Republic was to be the enemy that we were to meet. It therefore became necessary at the very earliest start from Barkly to treat the expedition as being in an enemy's country. The earlier part of our marches were all carried on under the escort of cavalry, or mounted infantry, and the telegraph was laid and protected in exactly the same way as if expecting an attack at any moment. We always laagered at night, and proceeded with these precautions as far as Taungs. The distance covered each day by the advance was about 6 miles—6 miles a working day—and that was the rate of progress we carried on throughout the whole 350 miles of wire that were constructed. No doubt the number of miles a day that can be done in telegraph construction depends absolutely upon the number of men. We had not sufficient men to find more than two wagon detachments a-day, and frequently could only find one detachment. If we had had more men we should of course have done more, and on occasions we actually did as many as 9 and 10 or 11 miles, but that was on special occasions when it was of importance to complete a section of the line. Looked at strategically, the line selected strikes one as being somewhat hazardous; that is to say, it is carried on the whole distance within from 5 to 30 miles of the borders of the very people who were supposed to be our enemies. Of course that was entirely beyond the control of the telegraph staff; we merely had to do what Sir Charles Warren required for his own march. As far as Mafeking the telegraph was, as I have said, constructed at the rate of 6 miles a working day, for that distance of 220 miles. The distance from Mafeking up to Molopolole made the total length of the wire 350 miles, but that addition was merely made subsequently for the purpose of the occupation. That also carried on at the same pace, though without the same precautions that were taken at those earlier portions of the proceedings when we did not know how far we were likely to be opposed, or how far we were to be let go without attack. Our main difficulty was to get sufficient matériel. The whole of it as I have said had to come from England. When we first went out we only had 100 miles, of which only 20 miles was actually with us, but the remaining 80 miles reached us before we got to Griqualand West, and, therefore, in time for us to use for our first distance. In the whole of South Africa, to show how very dependent we were on what we got from England, we had the greatest difficulty in scraping together 30 miles of wire, and it took several weeks to get this. It must be remembered that we had to drop at every one of the eleven stations at least one clerk and one lineman. That being so, you will readily see that we were exceedingly pinched for men, but there is no doubt that the men we had got had derived great advantage from the fact that they had been practised together in peacetime. There is no doubt that certain campaigns out that we had had in the summer, by which we had been enabled to teach the men exactly what would have to be done on active service and in open country, helped greatly towards the rapid execution of the line that we laid. The strict discipline of peacetime also prepared the men for the positions of great responsibility and independence which must necessarily fall to the lot of clerks and linemen on active service. Small parties had to be left along the long line of communications with all sorts of temptations in the shape of stores, public-houses, &c., in their way, affording them every inducement to go wrong, but I am happy to say that I was particularly complimented by Sir Charles Warren upon the extraordinarily good behaviour of the men. That being the case, I am glad to make public recognition of it, and of the way in which they did justice,

when they came actually to be tried, to the pains which had been taken with their discipline in peace-time. Of the Bechuanaland Expedition there is nothing more particularly to be said, except that the line not only worked very well during the expedition, but I am happy to say that the 220 miles to Mafeking is working as well at the present time as when it was erected fourteen months ago. Now turning for one moment to the general question of the training of the men, and the suggestions that are being made with reference to improving our organizations for the future, the thing that mostly strikes me, as being rather an old hand at telegraph work (for I was with the troop when it was raised fifteen years ago), is the fact that notwithstanding the great advantage of pay and position that are offered in the Engineer service, it is with the very greatest difficulty in the world that we can get sufficient men to fill the ranks. Both at Aldershot, in London, and at Chatham we find the greatest difficulty in the world in getting men to enter, even with the attractions of good pay and allowances, so as to fill our ranks with the proper class of men. I cannot myself see how we are likely to improve that by going out into the highways and byeways. It seems to me that our great object should be either by some new system of enlistment and training, or by encouraging the enlistment of boys, and teaching them as boys, to try and get the very best men possible for the organization *as it exists*, getting them taught to be good telegraphists when young, and then gradually passing them into the reserve. What happens now is that almost as soon as we have trained a man we pass him to the reserve (and the very best thing too, because when we come to a large campaign we shall want such men badly enough). Still we must have something to carry on with, and certainly as far as my experience goes, whether we try army men or civilians, it is with the very greatest difficulty that we can get men suitable to fill these posts. No doubt so far as it went, the experiment of enlisting Post Office Volunteers into the ranks, and passing them into the reserve, has succeeded admirably. I know that as clerks they served us remarkably well, though I fancy that in the matter of discipline and soldierly qualities perhaps they had not got all that might be expected from those who had had a longer training. But when we come to trying to get assistance from the line, my experience has been most unfortunate. Throughout the whole of the Bechuanaland campaign, with one cavalry and four infantry regiments in South Africa, notwithstanding all my efforts to get some assistance from them, we could only get two men. One had only been a soldier a very short time, but we were able to make him fairly useful. The other was sent for 1,400 miles from the Welsh Regiment in Natal, with great paraphernalia and flourish of trumpets, and sent to Barkly. We found him absolutely useless, and for the whole of the rest of the campaign that man had to act as cook to the detachment. The same sort of thing has met me at other places. At Aldershot, where you would think that if there were any men to be got, we certainly should be able to hear of them, I can only say that it is not possible to get men from the line to work even the camp offices. I had the same experience at Gibraltar, where a few line and artillery men were employed in the military telegraph offices, but I always found it the case that if one fell sick or committed himself recourse always had to be had to the Engineers. I therefore cannot think that there is very much recruiting ground for us in the line, particularly at the present time, when, in consequence of the number of things that have to be taught, it is almost impossible to get men for any purpose whatever. Directly a man is found to be a good telegraphist he is probably also a good clerk, and as such is absorbed in the orderly room, whence I defy anybody to fish him out. I wish to add on behalf of myself and my brother Officers (as I happen to be the senior Officer in the Telegraph Battalion at the present time) that we fully recognize the fact that we must not stand still, and that we are only too anxious to do our utmost to meet the requirements of the times. Still I hope and believe that we may point with a certain amount of satisfaction to the fact that with all our faults, we have been able to carry out in the last eighteen months on a peace establishment three simultaneous campaigns, I hope without discredit to ourselves and with a certain amount of satisfaction to those under whom we have had to serve.

Major-General WEBBER, C.B., R.E. : I think I may safely say that never before in this theatre has such an interesting account been given of telegraphs as that which we have heard from Major Beresford to-day. My experience is that when a lecturer

attempts to deliver an account of the history of telegraphs, he must necessarily leave out a great many instances and examples of very great interest, and perhaps it would be better on such occasions if he confined himself to referring to the other accounts which are on record in our proceedings. This has particularly impressed itself upon me because Major Beresford has apparently been unable to obtain—and I believe it is at present difficult—a good account of the extensive and most valuable telegraph operations of the Afghan War. If any Officer here to-day can tell us how well the telegraph and signalling were there combined in the same service, it would be a very valuable record in the debates of this Institution. There is no good account of it, I believe, unless it be in the records of the Government of India, and it is certainly a great loss to the history of military telegraphs. As regards the subject of the uses of telegraphs in time of war, there is one which, I think, our present Chairman will testify to as being most valuable to the commander of an army, and that is the power of holding conversation. No one who has ever carried on a conversation, or who has been in the habit of doing so from time to time by means of a telegraph, can forget how he realizes being brought face to face with either his superior or his junior Officer at a distance of many hundred miles. All he has to do is to sit down beside the instrument, which the telegraph clerk manipulates, and with a piece of paper by his side and a pencil in his hand, record the questions and answers as they follow one another. His correspondent at the other end is doing the same, and it may be safely said that the speed of that conversation is very little less than half that of a conversation in which actual conversation was being carried on. The power of asking questions and of rejoinder, the power of obtaining alternative information, and so forth, is so great, that those who have used its aid must feel that large operations, where great distances intervene, could not be carried on without such means quite independent of the ordinary service of the telegraph, which, I may say, in such operations as the Nile Expedition, comprises the whole correspondence of the army. With regard to outpost telegraphs, which Major Beresford strongly advocates, I am rather sceptical. Years ago I had the opportunity, knowing the Director-General of Telegraphs of the German Army, of discussing this subject with him—and I must say I could not help agreeing with him in every word—he then said that the attempt to use the telegraph under the ordinary conditions of outpost duty was really out of the question. In this theatre myself, I have more than once said that a telegraph which is not served and maintained in the most perfect way is worse than no telegraph at all. Within the distance of outposts from the headquarters of an army corps or a Division, I believe that all who have ever been in command or have read an account of what precedes actions, either in the night or in the day, must know that there are indications in the air, that there is the sound of outpost firing, the sound of artillery, which tells every General and Officer in the Army almost instinctively what is going on; and I have very little faith in that sort of security which rests or depends on a telegraph instrument and on a wire lying on the ground, as a means of giving information to the Generals or Staff Officers, or telling them what the movements of the enemy are. In the American War, the orders to and the instinct of every General and Staff Officer were to move to where they heard the nearest firing, and I do think that that instinct which teaches us what to do, more or less may be lessened in its keenness if telegraph wires are known to be lying about between the headquarters and the outpost—a feeling which would only be lessened by the perfect knowledge and consciousness of the General as to how unreliable they are. Under this head I do not think that Major Beresford's scheme of regimental telegraphs is a very workable one; I do not say this from any feeling that such an organization, and such a unit in the economy of a regiment, might not be very useful to the men and very instructive to the Officers; but I think I know as much in the past, as Major Jelf has told you, of the difficulty of obtaining men to do this work from the infantry or the cavalry. I remember the day when the first Officers and men were placed under me in the 1872 manœuvres, who were thought to be trained signallers, and I know how little they were able to do. We all know the high state of efficiency to which that body has attained, and I believe if there is to be any means of communication of a telegraphic nature in the regiment, it is better that they should confine their duties to that which they have proved themselves well able to perform. We, as I said before, do not know so much

as we ought to do of what was done in the Afghan Expedition by regimental Officers and men in signalling. If signalling is to be confined to the regimental unit where it can be well taught, I would do everything I could to improve that knowledge, to encourage it even more than it is now encouraged, and from time to time to bring large bodies of signallers together. This has been attempted in some cases very successfully, but I do think it might go very much further, and that long lines of signalling, which is really one of the most difficult things to establish and work out, should be a part of the summer manoeuvres of our Army every year, both at home and abroad. Unfortunately there is one thing which, I think, has been a mistake in our signalling system. About ten years ago a revised edition of the signalling book was brought out with a most extraordinary result; it appeared that whoever made the revision desired that signalling and telegraphy should have an insuperable gulf established between them. The very alphabet and syntax of telegraphy was varied in signalling. With the view to approximate the systems, Colonel Malcolm, R.E., and I spent much time in revising the old edition. It went forward (as the term is), and we only heard from time to time rumours of what was being done. A few months after the new edition came out, diverging more than before. The only thing untouched was the preface which I had written myself. The evil consequences have been many. If the author's shade wanders here below, he may like to know how the evil of his deeds has lived after him. I think on every occasion on which I have seen signalling and telegraphy used in the field, there has been the most unhappy want of union and the most miserable absence of power to work together. Considering that they are both means to the same end, there can be no doubt that this proceeding is most irrational. The telegraphists and signallers of the Army only come together on occasions, and it is only common sense that on those occasions they ought to be able to work on the same system, and if there is any organization they ought to work under the same direction. I think that every signalling Officer who has had experience will cordially agree with me in this. I can't help endorsing every word that has been said on the subject of good training. We have been for sixteen years trying to organize a good telegraph service in this Army. It has grown up step by step; we may be very much to blame that we have not done it in less time, but I think now it has reached a point at which it may be said to be a good organization, which has stood the tests of late campaigns and has not been found wanting. I think those who have to do with these things will be best advised if they will allow the organization to go on on its present lines until it fails; then is the time to change and do away with it, or improve it in some other direction. There is a great craze for change with some people, and when there is a good thing they want to knock it over. Now our signalling is a very good thing, and our telegraphy is a very good thing; I should like to see them both go on on their present lines, only let them have the same language, the same alphabet, the same procedure, and when they take the field let them work cordially together to the same end.

The CHAIRMAN: I am sorry that I am obliged to go away, but before I do so I should like to add my mite to the discussion on this most important and really vast subject. There have been two or three things said that I may, perhaps, throw out a hint about. I have myself no knowledge of telegraphy, but I have had a good deal of experience of army telegraphy, and of the way the Officers and men of our Telegraph Battalion do their work in the field; and I am quite sure it is impossible for anybody who has not seen the men at work under the very difficult circumstances of field service really properly to appreciate the admirable manner in which that work is done. On two occasions I have had the general supervision of work that extended over a great extent of country, and was carried on entirely by telegraph, and on both occasions, the length of each being nearly a year, I never had one single complaint, and I hardly knew of any slip, however slight, on the part of any Officer or non-commissioned officer or man employed on telegraph duties. They were placed, most of them, in most uncomfortable positions, in tents, in stables or houses, with no proper accommodation; the work was incessant day and night, and the way in which it was performed was excellent beyond words. I should not be doing common justice if I did not say so. Something has been said against telegraphers from the line; that is my own branch of the Service, and I must to a certain extent defend it. Colonel Jelf was rather hard on the line

telegrapher. We do not, in England, attempt to teach soldiers of the line anything to do with telegraphs, but I believe a considerable use is made of them in India, and on every occasion on which I have been employed abroad with any regiments brought from India, there has always been a certain number larger than would have been expected of good telegraphers. I think Colonel Webber will bear me out in saying that in the Nile Expedition the telegraphic work in the advanced post was carried out in the early part of the campaign by privates of the Berkshire Regiment; and in 1881, in the Transvaal, a considerable accession of strength to the telegraph section out there was obtained by employing men of the 92nd and 60th, and the other two regiments that were brought on from India for the purposes of the then campaign. I think if we were to train in England a certain number of linesmen we should find they would give as good results as those linesmen do in India. Major Beresford mentioned in his lecture the fact that a bare wire was, during the little expedition, laid along the ground for use as a telegraph wire. It was, no doubt, his modesty which prevented him from adding what I believe is the case, that the buzzer that was used with that wire is due entirely to the invention of an Officer of the Royal Engineers, or at any rate that its present improved state is due to the invention of an Officer of Engineers—I would suggest for consideration by those skilled in the matter whether we have sufficiently tried the telephone in war. I cannot help thinking that in the case of the very conversations that Colonel Webber alluded to the telephone would be more useful than a telegraph instrument. When a senior Officer is holding a conversation with a junior Officer, the junior Officer, even if he wants to ask a question in the middle of a sentence, does not like to stop the operator and ask, but he could do that with the telephone. It occurred to me once, in the course of a conversation with a senior Officer, lasting nearly an hour, that the clerk taking down one word wrong threw out the whole sense of my instructions. I should have asked the question at the time and stopped him because I thought it was wrong, but I did not like to stop the long instructions I was receiving. I asked, afterwards, but my question was not understood, and consequently I misunderstood the instructions. Another point for consideration is that mentioned by Herr von Treuenfeld: "Cannot we decrease the weight of our insulated wire, and have we yet obtained the lightest and best insulated wire we can get?" I do not know enough of that question to go into detail, but it appears to me that the greater the length of insulated wire we can carry with our field telegraph the better it will be for us.

The Chair was then taken by Sir J. STOKES.

Major E. J. BROWELL, R.A.: Major Beresford, in his very interesting lecture, has alluded more than once to the signallers at Suakin. As I had charge of the signalling arrangements in the last campaign there, I should like to make a few remarks on the subject. He stated that when the telegraph was broken down the signallers took up the running, but that although they rendered valuable assistance they did not adequately fill the gap. Of course they did not, and I maintain that no signallers in the world could do so. Of course a telegrapher can send his messages very much quicker than a signaller; he sits in his tent with his instrument by his side, and does his work in comparative quiet and repose. The signaller on the other hand, is perhaps on the top of a rickety crow's nest, and by the very nature of his instrument exposed to the sun and the dust all day long. Of course there is no doubt in the world that the signallers are not as efficient as telegraphers. Major Beresford has said that the operators he had with him were some of the best the Post Office can produce, so that in any case I maintain that if there was a pressure on the telegraph, and its work was transferred to signallers, there would naturally be a block. Colonel Webber said the language of signalling was different to that of telegraphy. It was certainly the case some time ago, but I know the idea now is to assimilate it absolutely to the telegraph, and I believe it is exactly the same. Major Beresford mentions with regard to Sir John McNeill's zarefa, that "at 7 P.M., the line was cut, and signallers took up the running with camps to the Right Water Fort." It may be interesting to the meeting to know what the signallers did that day. They went out completely equipped, with Sir John McNeill's force. On arrival they communicated with the Right Water Fort, and maintained communication more or less all day, but of course the General

Officer commanding used the surer and quicker medium of the telegraph wire for his official messages. The fact that when the line broke the signallers took up the running is, I hope, to be considered satisfactory to the signallers generally, especially as very hard work was got through, comprising messages containing the regimental numbers and names of the killed, wounded, and missing, the work extending far into the night. The wire was certainly mended the next day. The day following it again broke, and the General gave orders that the wire need not be repaired any more as the heliograph was working so well. A few days afterwards, during the advance on Tamai, the signallers had a great press of messages to work through. One press message came in 205 words, and so on. From the extreme point reached, messages were written by Sir Gerald Graham right away to the Queen and Lord Wolseley, and heliographed as far as the Right Water Fort, where the field telegraph had an instrument.

Captain CARDEW, R.E. : I have here an instrument, a portable telephone box with vibrating call, which I should like to exhibit, though as it only came up this afternoon, I have not had the opportunity of trying it. Major Beresford, in his paper, alluded to these vibrators (Transmitter, Vibrating, Mark II), and I think, on one occasion, he called them Theiler's sounders, and, on another, vibrating sounders. This instrument is not used by us as a sounder at present. It might be described as a vibrating sounder by itself, and was originally deduced from the instrument known as the vibrating sounder. We use it as a transmitter, that is to say, as a means of converting an ordinary battery current into a vibrating current, which has more effect on the receiving instrument, viz., the telephone, and thus more efficiently utilizing the telephone as a receiving instrument for telegraphic signals. The battery current is converted into a vibrating current of a certain period, which is far more audible in a telephone than the mere make-and-break signals such as the signals in the ordinary Morse key. The chief advantage of the telephone as a receiving instrument is that it never requires any adjustment. Any of the ordinary Morse instruments require delicate adjustments, and if the current strength alters from time to time, as is often the case on field service, and the instrument requires readjustment, it sometimes leads to considerable delay, particularly when communication is wanted to be established after an interval of rest. If the receiver does not get his call signal owing to want of adjustment in his instrument, there is very often considerable delay. The telephone always responds to the call however it is varied. That is the principle of this system. I need not go into the details of the connections, except to say that the vibrator is put across the battery so that the current to it is always the same, and is independent of the condition of the line. It should not, therefore, often require readjustment, and even should this be necessary, it does not entail serious delay, as the instrument is at the sending end of the line. I have here another instrument, a portable telephone box, which is intended for a purpose which should be kept distinct, that is, for telephoning as distinguished from telegraphing. Unfortunately, in order to make the telephone sufficiently audible at any rate to inexperienced ears, it is necessary to use a microphonic transmitter, that is to say, to make use of a battery current modified by the action of speed, and not merely to speak into the telephone itself. Of course everybody knows you can use the telephone to speak into; it is both transmitter and receiver; but it wants a good deal of practice to hear with this arrangement, whereas the use of a microphone gives you a louder result. Colonel Jelf asked whether we could get men at Chatham. I may draw attention to the fact that we do not profess to retain telegraphers there, in fact whenever I get a good telegrapher he burns in my hands till I get rid of him. I regard him as quite wasted at Chatham, and he should be doing service in the Telegraph Battalion. As regards the training of men, I do not think it is feasible. I have a good deal of experience in instructing men in telegraphy, and I do not think it would be feasible to take the ordinary Tommy Atkins, as he enlists, and with his present short service make him an efficient telegrapher before we have done with him, but I do think a great deal can be done by taking boys. The proper way to train telegraphers is to take boys as young as you can, as is done in the Post Office. If you take boys who have had a good schooling, you will train them in about one quarter the time that it takes to train a man, and they become very much more efficient.

Lieutenant-Colonel HAMILTON, R.E.: I only want to say two words in confirmation of what fell from Major Browell, that the system of telegraphy and of signalling are now as nearly identical as possible consistently with the different instruments that are used. I say this because about two years ago I was on a Committee in conjunction with the Inspector of Army Signalling in revising the "Manual of Army Signalling," which was then brought into exact harmony with the telegraphic system.

Major BERESFORD: I am very sorry that time did not allow us to hear Herr von Treuenfeld to the end, and I only hope he will give us the remainder in writing, because I have no doubt everything he gives us on the subject of telegraphy is most valuable. He spoke of insulated wire; I have here a new pattern of insulated wire, sent in by Messrs. Siemens Brothers, which Herr von Treuenfeld expects will cut out everything else, including D. 5. Its core is a combination of steel and copper, and it is said to be not only very much lighter, but very much stronger than our D. 5. There is also a pole exhibited which Messrs. Siemens have sent in as an example of how light an iron telegraph pole can be made. I have also here an insulator, proposed by Herr von Treuenfeld as a field insulator. I cannot agree with Colonel Jelf's remarks about men from the line. There are many men, capable of being trained as telegraphists, to be had from the line regiments—there is not the smallest doubt about it—if you can get hold of them from the commanding Officers. I do not say the very best man, but one of the very best men of my section at Suakin, was a 92nd Highlander from the Reserve. At the present moment he is employed by the General Post Office as a civilian, and has been promoted, or is about to be promoted, in that department. When we left Suakin, the telegraphs were taken over by the Shropshire Regiment, and they have been working them up to the present time. They may not be able to do the work as well as Telegraph Battalion men, but they can perform good service, and with further training they would become more and more efficient. In India, men from all regiments are employed. I had a conversation yesterday with Mr. Reynolds of the Indian Telegraph Department, and he gave me a very interesting account of how the telegraphs are worked in India. He had the preparing of all the material for the Afghan War, though he was not himself present at the field operations. There was a very good piece of telegraph work done in India some years ago in connection with the famine—that telegraph was carried on under the superintendence of an artillery Officer, Major Mallock, who, I think, is now at the top of the tree in the Telegraph Department. General Webber said there was no account of the telegraph operations in Afghanistan. Mr. Reynolds told me that there were two accounts to be found in the "Proceedings of the Society of Telegraph Engineers." I have not, as yet, seen them myself, but General Webber may know of them—one is written by a gentleman of the Indian Telegraph Department who was present himself during the operations. General Webber said he had very little faith in outpost telegraphy, and that it has not been tried. Well, all I can say is you do not know what you can do till you try. Twelve years ago at Aldershot there was very little faith in the Telegraph Troop itself. I remember on one occasion at that particular time when we were supplied with an exceedingly faulty cable and worthless instruments; there was a battle out on the hills to the south of Aldershot. One division of the defending army was on the Hog's Back, and the other on Hungry Hill and at Cæsar's Camp. Captain Macgregor, afterwards killed in the Transvaal, and I were working the telegraph; he was on the Hog's Back, and I was on the other flank; the line was working perfectly for a wonder, and early in the day he telegraphed to me as follows: "The enemy are leaving our front, and moving towards your flank, so look out." I brought this telegram to the General, and he laughed at me. He hinted the telegram was a creation of fancy, and he did not believe in the information for a moment. Half an hour after that, the enemy were across our right flank, and rolled us up into Aldershot; such a defeat was never suffered in peace manœuvres before or since. Sir Redvers Buller mentioned the telephone. I think the telephone in some cases would be most useful, but I do not think when any active operations are going on that it would be reliable. The telephone is not such an accurate instrument as one may think—the words are very likely to be misunderstood—I prefer the sounder as being far more reliable.

Certainly the telephone saves clerks, for it is not necessary that a telegraph clerk should be present to work a telephone. Major Browell spoke on behalf of the signallers. In my remarks about them, I did not mean to say all that could have been done with the existing means was not done; I know it was carried through with credit by the Officers in charge; but what I assert is, that the men that were given were not educated enough for the work in connection with the telegraphs, and that if Major Browell had had telegraphers under him who were signallers also he would have done a great deal more. At McNeill's zarefa, the signallers did their work excellently, but that was not on the main line of army communication—not where the press of traffic was going on. I do not think I have any other observations to make except to thank the gentlemen who have been present at this lecture.

Sir J. STOKES: Gentlemen, you will not expect many observations from me as I have taken the Chair at very short notice. I should like, however, to make one or two remarks on what has passed. And first I must say it is extremely gratifying to me as an engineer Officer to have heard Sir Redvers Buller's high encomiums on the work done by the Telegraph Battalion of Engineers in the field on all occasions which had come under his notice, and I am sure it must have been highly gratifying to the Officers of that battalion present to have heard those encomiums. As regards the observations made on the probability of using the men of the line and cavalry with the engineers, I am certain that in individual instances there may be very excellent telegraphers found in those branches of the Service; but it seems that on some occasions when they have been most wanted there have been great difficulties in getting hold of them. I am equally certain that whenever they are found they will always be welcomed and gladly attached to the Telegraph Battalion of the Royal Engineers as most valuable auxiliaries in the work they have to do. I cannot help thinking that those who wish to establish a different order of things to that which now exists do not fully realize the extreme difficulty of finding proper material in men and training them, and getting the boys and training them for the work they have to do; but, as I said before, we shall always be glad to receive assistance from the other branches of the Service if we can get it. As regards the proposition of telephoning, I think Sir Redvers Buller lost sight of one very important difference between sending telegrams and speaking by telephone; there may be an occasional mistake in the telegram, but at all events it is recorded, and whatever is sent stands and remains on paper and can be referred to hereafter as a proof of the wrong order having been given; but in the telephone the order is heard, forgotten, and passes away, and there is nothing to prove what the order has been. I think that would be a very great difficulty in sending military orders by telephone. I cannot sit down without asking you to record a vote of thanks to Major Beresford for the admirable paper he has read to us. And I think we owe very much to the gentlemen who have taken part in the discussion, for they have thrown a great deal of light upon the question, and in saying this I must especially mention the remarks made by Herr von Treuenfeld.

Friday, May 7, 1886.

MAJOR-GENERAL SIR ANDREW CLARKE, G.C.M.G., C.B., R.E.,
Inspector-General of Fortifications, in the Chair.

THE DEFENCE OF LONDON AND OF ENGLAND.

By Major H. ELSDALE, R.E.

PART I.—*The Security of London against a Coup de main.*

THE apparent indifference of the British public to the most important and vital questions connected with the defence of the Empire, and the languid and fitful interest in them displayed by the Government, are most distressing to every well-informed member of this Institution.

Professional papers and discussions within these walls exert, it is to be feared, but little direct influence towards the enlightenment of the people generally. But indirectly they have their value. They clear the air and tend to the formation of an enlightened and matured body of professional opinion on important questions connected with our defences and the maintenance of our Imperial position. This reacts in its turn through innumerable channels upon the country generally.

But whether this be so or no it is our duty to deliver our testimony. It is our duty, as it seems to me, to have a well-considered opinion upon these important questions, and to be always ready to support and maintain it. And in order that such opinions may be sound and defensible it is most desirable that individuals among us should here submit any views or ideas which they may have been enabled to form on any of these great questions connected with our defences to the judgment of their brother Officers in both Services. The subject will then be well ventilated, and individual opinions corrected and enlightened. It is in such a spirit that I would now venture to invite your consideration of the important question of the defence of London.

There is no need to go into elaborate statistics to show the huge population, the vast exports and imports, the immense mass of shipping, the altogether enormous amount of property involved, and the magnitude of the interests at stake in the security of the metropolis itself. This, however important, is but a small part of the general question, only the outer fringe of it. For let us consider for a moment what the loss of London really means. The capture of London by an enemy means that that enemy has grasped England firmly by the throat. He can force his own terms upon her wherever British interests are at stake all over the world. It means the loss of our

Mediterranean fortresses, which are an object of supreme desire to the Mediterranean Powers, Egypt and the Suez Canal in the hands of the French, Simon's Bay and Cape Town given over to an independent South African Republic or to a foreign Power, the total loss of our communication with India, and India itself gone from us. It means our empire of the sea destroyed, our enormous mercantile marine sailing under other flags, and the course of trade diverted into other channels never to return. It means an enormous war indemnity to be paid, a largely diminished revenue from which to pay it, and the country weighed down by a crushing load of taxation. It means a bankrupt exchequer, pauperism and crime rampant everywhere in our midst, and England hopelessly degraded to the rank of a third or fourth rate Power. I do not, of course, assert that all these consequences will necessarily and at once follow the capture of London. But who will be bold enough to deny that they are all potentially wrapped up in it, and that any or all of them may be looked for as a natural and direct consequence of it? Like Carthage of old we have built up a vast and highly artificial edifice, based not upon broad acres of fertile soil, but upon maritime superiority and commercial success. Its centre of gravity lies in London. When London falls will not the whole fabric be likely to go with it, like a child's palace of cards when the foundation story is upset? So Carthage fell and her wide dominions fell with her.

The defence of London is then of supreme importance to the whole British Empire. The French, whose interests in the safety of Paris are far less than ours in that of London, have first constructed a whole series of formidable works for its defence, and then finding by their war with Germany that these were insufficient have set themselves to remodel and improve those defences on the most elaborate scale, thus deliberately and after the most crucial experience recognizing the necessity for defending their capital. Is it possible that with such an example before us we yet do not think it worth while to spend a penny on the defence of London?

But, it is continually said, there is the Navy to defend us. No doubt there is, and a very evil case we should be in without it. But without pretending once more to discuss the thrice-discussed question of the strength of our Navy, and taking only the broadest and most general view, let us ask any well-informed naval Officer whether he thinks the Navy has ever been in this generation, or is likely to be in the immediate future, strong enough to protect our vast commerce all over the world, to ensure the safety of our food supply, to meet and beat any possible enemy's ships on the high seas, as well as to guard our shores from a landing and our unprotected commercial harbours from the enemy's cruisers, besides securing its own as yet unprotected coaling stations abroad. Is there a capable naval Officer to be found anywhere who in view of the unknown and dubious elements introduced into naval warfare by the competition between guns, armour, ram, and torpedoes, and the confessedly uncertain course of the next great naval struggle, will think it reasonable or justifiable to throw upon our Navy the tremendous responsibility of being the

only reliable barrier to the invasion of our shores and the loss of our capital? And is it not a matter of the simplest common sense that the way, and the only way, to set our Navy free for its most responsible and arduous duties on the high seas and all over the world is to protect all our great ports and harbours independently of it, and to arrange without it, to give a good account of any possible or probable enemy landed on our shores. When the strong man's house is strongly guarded at home he is in a position to put forth his strength wherever it may be required abroad. Otherwise all his efforts abroad will be perpetually hampered and paralyzed by the necessity of keeping an eye always fixed on his house at home lest the enemy should burn it down during his absence. These things are so simple and so undeniable that I should apologize for stating them once more were it not that so much error and confusion of thought seems to prevail popularly upon the subject that we cannot apparently repeat the facts of the case too often.

Another reason which has probably contributed largely to prevent the defence of London from being seriously considered, is the idea which prevails generally that nothing can be done, or nothing worth doing, in the way of such defence without going to a vast expense in a huge chain of forts or permanent works all round it. It would ill become Officers of a corps whose primary duty is fortification to disparage what may fairly be termed their own speciality. Nor am I for one moment prepared to contend that the construction of a suitable chain of powerful permanent works for the defence of London capable of resisting a regular siege is not an object in itself desirable, and one which a strong and patriotic Government might not most reasonably undertake, considering the vast interests at stake. Hereafter we will further consider this question. But for the moment let us lay aside all professional or other prejudice, and simply ask the question, Without going to the very large expense which such permanent fortification undoubtedly involves on the one hand, or leaving our capital in its present defenceless condition on the other, is there no middle course which at a very much less cost would go a very long way to render London practically secure, by making its capture a task of such magnitude, difficulty, and uncertainty as would, under all ordinary circumstances, and so far as we can reasonably foresee, be sufficient to prevent any possible enemy from attempting? Because the Government is not prepared at this moment to give us the 4,000,000*l.* or thereabouts required for fortifying London thoroughly and properly, are we therefore to sit down and fold our hands and do nothing, without asking for the much more moderate sum necessary for providing our field army with a strong reserve position to occupy or to fall back upon for the defence of our capital? Cannot such a strong defensive position be forthwith established at a very moderate cost, and afterwards strengthened and reinforced by permanent works to any required extent whenever the money may be forthcoming for the purpose? Most undoubtedly I think it can. I propose to devote this first paper to an examination of this question.

Let us first review briefly some of the leading and governing condi-

tions with which we have to deal, and then consider how best to meet them.

The first cardinal condition with which we have to reckon is, it seems to me, this : that the defence of London against a *coup de main* is a separate and very distinct question from that of permanently fortifying it in a regular way, and a matter in itself of far more urgency and importance. By a *coup de main* I mean a sudden invasion by such a number of troops as the enemy could reasonably be expected to ferry across the Channel at or about the same time. The exact number which could be so transported is a matter which is open to much argument. Following the authority of General Collinson, who has carefully considered the question, I shall here place it at a maximum of about 150,000 men. But without entering into any discussion of the exact figures, for which we have no space here, and taking the above number as a sufficient approximation for practical purposes, I hope it will be generally agreed that the moment we place it out of the power of the enemy to begin and terminate the invasion of England at a blow by a rapid march on London with such forces as he can bring on to the scene at once, whenever he can succeed in obtaining the temporary command of the Channel—that moment all the conditions of the case are radically altered. The problem of the successful invasion of England then assumes a very different and far more formidable complexion. For in order to maintain and supply the large force which will then be necessary for successful invasion, the enemy must first capture and establish himself securely in a more or less convenient and commodious harbour or port on the coast as a base of operations. He must undertake large and leisurely operations involving the command of the sea for a prolonged period that he may be able to bring up strong reinforcements and great trains of supplies with reasonable certainty. He must necessarily give an invaluable breathing time to the defence, and we shall be enabled on our side to concentrate to resist him the whole power of a highly organized country like England, rich in men, material, manufacturing appliances, railways, transport, telegraphic communication, and all the elements necessary for developing an enormous military and naval strength. The capture of London instead of a single operation will then become the goal and climax of a whole series of separate and more or less distinct operations, involving at each and every stage fresh chances for the defence and fresh possibilities of failure and ruin to the attack. These successive stages of the problem I propose to examine in more detail in another paper. Let it suffice now to submit to your judgment that the security of London against a *coup de main* or sudden attack by a moderate force is a matter of the most pressing national importance, which ought to be considered and dealt with separately from, though no doubt in connection with, the further question of fortifying it against a more formal and leisurely attack by much larger forces. This latter, though doubtless important, is by no means such a pressing and urgent matter. And many other conditions and collateral questions here come in and demand careful consideration before we can assign to this question of the permanent fortification of

London its due and proper place in any well-adjusted general programme of our national defences.

The next ruling condition with which we must reckon, and which if we are wise we shall fully recognize at the outset, is that we cannot rely upon our present standing Army or upon the Militia, including, of course, their reserves, for the defence of London. It is out of the question. I do not propose here to go at length into the figures which have been repeatedly brought forward in this Institution. But this cardinal truth, upon which all our arrangements should be based, can be sufficiently perhaps exhibited by this consideration, that if we imagine any, the most ordinary, combination of circumstances under which the question of the invasion of England would be likely to be seriously entertained by a foreign enemy, or coalition of enemies, we shall find that all our regular troops are likely to be urgently required elsewhere and cannot therefore be relied upon at the critical moment.

Any number of such combinations may be imagined, and probably the real one whenever England is invaded will differ widely from all of them. For in politics and war it is almost always the unforeseen which actually happens. But let us assume, as no improbable or extravagant assumption, that we have been obliged again to dispatch a strong force to India to quell an insurrection among the large armies which the protected States are allowed to maintain, or to ward off a threatened invasion from the side of Afghanistan set on foot by Russia. Or, which is not at all unlikely, let us have to meet both these contingencies simultaneously. Or, again, let us be obliged to send a strong force to Egypt to reinforce our present considerable detachment there. This may happen at any time. In either case a large slice of our available fighting force will be required. If now we make up our Mediterranean garrisons to the considerable war strength which in the event of a war with a first-class Power or Powers will be urgently required, and allow only the most moderate and reasonable war garrisons for the rest of our important fortresses, harbours and coaling depôts all over the world, including a proportion of trained troops for Portsmouth, Plymouth, Weymouth, Dover, Chatham, and the Thames Forts, the defence of which is clearly a necessity, as well as a moderate garrison for discontented and restless Ireland, and a nucleus of defence for our leading commercial harbours, we shall find that we have practically no men at all left to defend London in case of invasion.

I do not of course pretend that no regular troops would actually be available for such a purpose. Other necessary objects, such as the proper reinforcement of our foreign garrisons, or the defence of our home ports and harbours, would have to be sacrificed more or less for it. And I shall assume that a mixed force of about 60,000 men from our regular troops with the Militia, especially the latter, and their reserves, will actually be available. I assume this, because be the pressure elsewhere and demand for men what it may, no Government would dare probably to leave less than that number nominally available for the supreme object of the defence of London, though a

considerable proportion of this number are then likely to consist of more or less untrained recruits. But the truth is that our small Army, Reserves and all, is only just adequate, if it be adequate, to its normal existing responsibilities all over the world, and to provide men for our frequent little wars. In case of a serious or prolonged struggle anywhere its weakness must at once become apparent, quite apart from any question of the invasion of England.

Are we then going here to propose to double our standing Army, or to double or triple our Militia, and increase considerably its annual period of training, to admit of a proper course of annual musketry instruction in addition to a respectable amount of drill, and so to render it a more efficient and reliable force; or to introduce conscription? By no means. For whatever might be the advantage of any such measures in the abstract, they are outside the range of any practical discussion of the subject at this moment, and quite beyond the scope of this paper. My purpose here all through is to consider what means are practically possible and desirable as matters now stand, without any remodelling of our existing military system, or any considerable departure from present arrangements.

It comes to this, then, that whatever may be the number of our Regulars and Militia who may fortunately be in England, and available for its defence in case of invasion—which is a very uncertain matter depending upon a number of contingencies which we cannot now possibly foresee—their strength is certain to be altogether inadequate, and the brunt of the fighting must fall upon the Volunteers. It is to the Volunteers, therefore, and to their requirements, that we must mainly look for the defence of London. This means that all our arrangements should be adapted as much as possible to the genius and capacities of our Volunteers. These should be anchored down to the defence of a given commanding position for the main struggle, and exposed as little as possible to the necessity of manœuvring in the open against the much better trained and more handy and manageable troops of the Continental Powers. Any such fighting in the open as may be necessary should then be reserved for any available regular troops of the line, supplemented, if required, by the best trained and most efficient battalions of Militia and Volunteers. These should be brigaded together and kept well in hand for the purpose.

I allow at a rough estimate for a total of 250,000 men available for the defence, of whom about 60,000 above will consist of our Regulars and Militia, with their reserves, and the remainder, 190,000, of Volunteers. In allowing for this large number of Volunteers, representing the greater part of their efficient strength, which is 218,000 at present, I presume a very large increase to their number at such a crisis as is here in view. For if the judgment of Officers who are entitled to speak in their name is to be accepted, it is probable that 200,000 or 300,000 extra men who have already been through their ranks and received the usual training necessary for a certificate as "efficient" will then forthwith present themselves for re-enrolment, so that their numbers will be doubled or more than doubled. Against this I make large deductions for men such as railway em-

ployés who cannot be spared from their work without disorganizing important and necessary industries, and for others employed in harbour and coast defence and in garrison duty. I therefore allow the above number of 190,000 men as available for meeting the enemy's main attack.

The question of time is of the greatest importance. Once let the enemy be established with a sufficiently strong force anywhere on the coast, and he will not lose an hour in marching on London. All his chances are bound up with pushing on. His well-trained troops are led by an experienced body of Officers to whom war has been a serious professional study. His object is to pit this compact and homogeneous mass, this scientific and well-adjusted machine, against our motley assemblage of troops in various stages of training and efficiency at the earliest possible moment. For he knows well that each day's delay represents a clear gain to the defence, and a harder task before him. If we can only gain time we can construct formidable works of defence, and can collect an enormous force to man them. For if the spirit of Englishmen be at all what it used to be, extra men will pour in by tens of thousands in such a crisis. We shall be likely to have more men than we can find arms for, or Officers and non-commissioned officers to instruct and lead, provided only we can gain time. It is clear, therefore, that it is our business to delay the enemy's march and yet avoid any serious action as long as possible. For a reverse to our forces at the outset would give the enemy a lead all through which we may never recover. It would encourage his troops by victory and depress ours by defeat, and go far to discount our chances in advance in the main struggle. An enemy's landing should of course be opposed by every means in our power, and when he has landed only a moderate number of troops every effort should be made to overpower and drive them into the sea before they can establish themselves firmly. But once let this have been done, and our proper course is while perpetually checking and delaying them at every step, to defer any serious fighting till we can fight at our own time and on prepared ground of our own choosing. The problem before us then is how to enable our composite force to fight at the greatest possible advantage in a very strong defensive position which the enemy can neither turn nor avoid. The defence must be capable of the easiest possible lateral movement to enable us to forestall any such flanking or turning movement on the part of the enemy, and make sure of being always beforehand with him.

The leading elements of our defence should also be simple, direct, and well understood, so as to admit of being taught to comparatively ill-trained men, and of being rehearsed by them on any favourable occasion in peace manœuvres. And our arrangements should be as mobile as possible to enable us to establish our line of defence at any threatened point and shift it as required to any other point at the shortest notice, or even to move it away from London and its defences altogether.

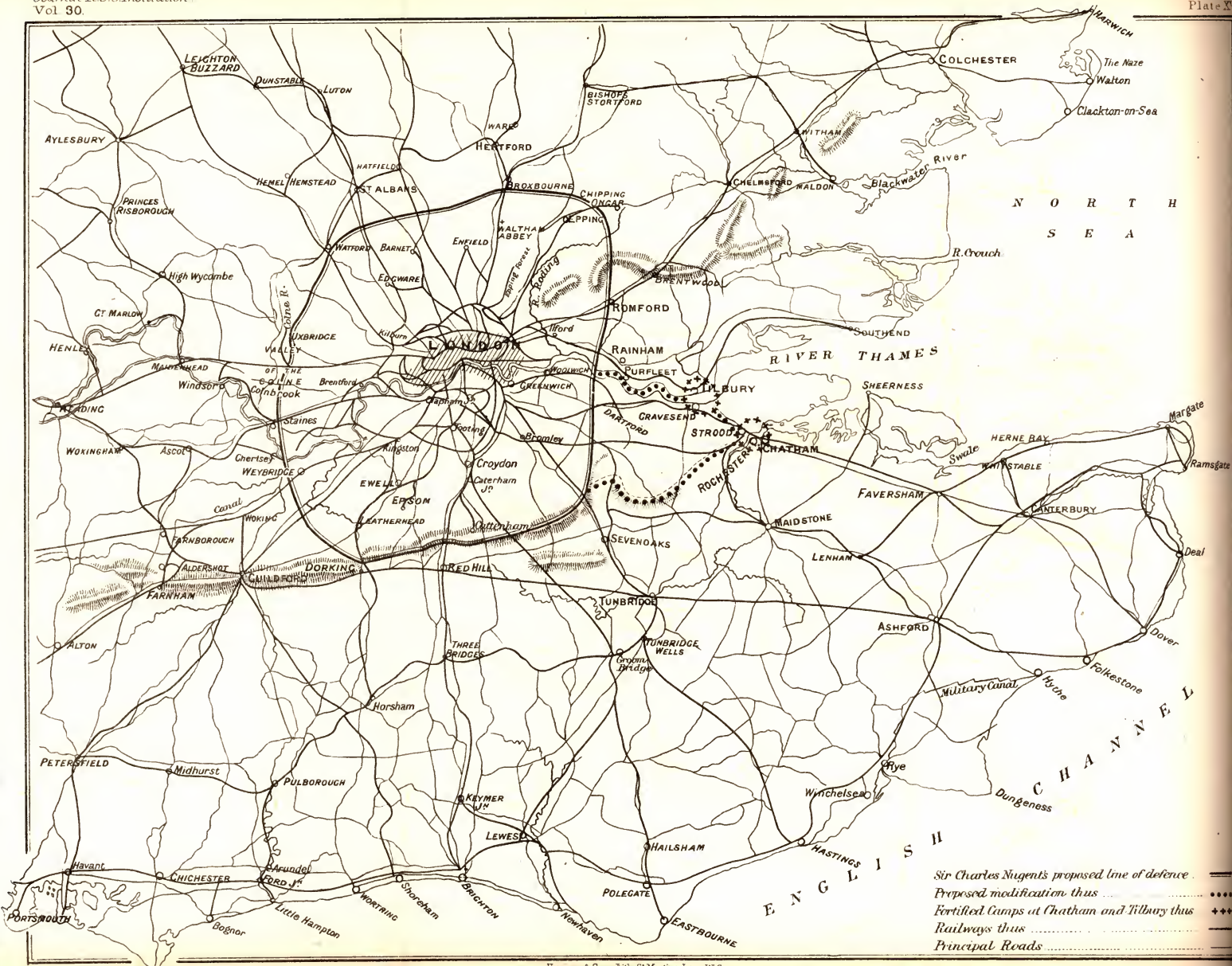
For here another very important and ruling consideration comes in, namely, this : that if we concentrate all our strength in any kind of

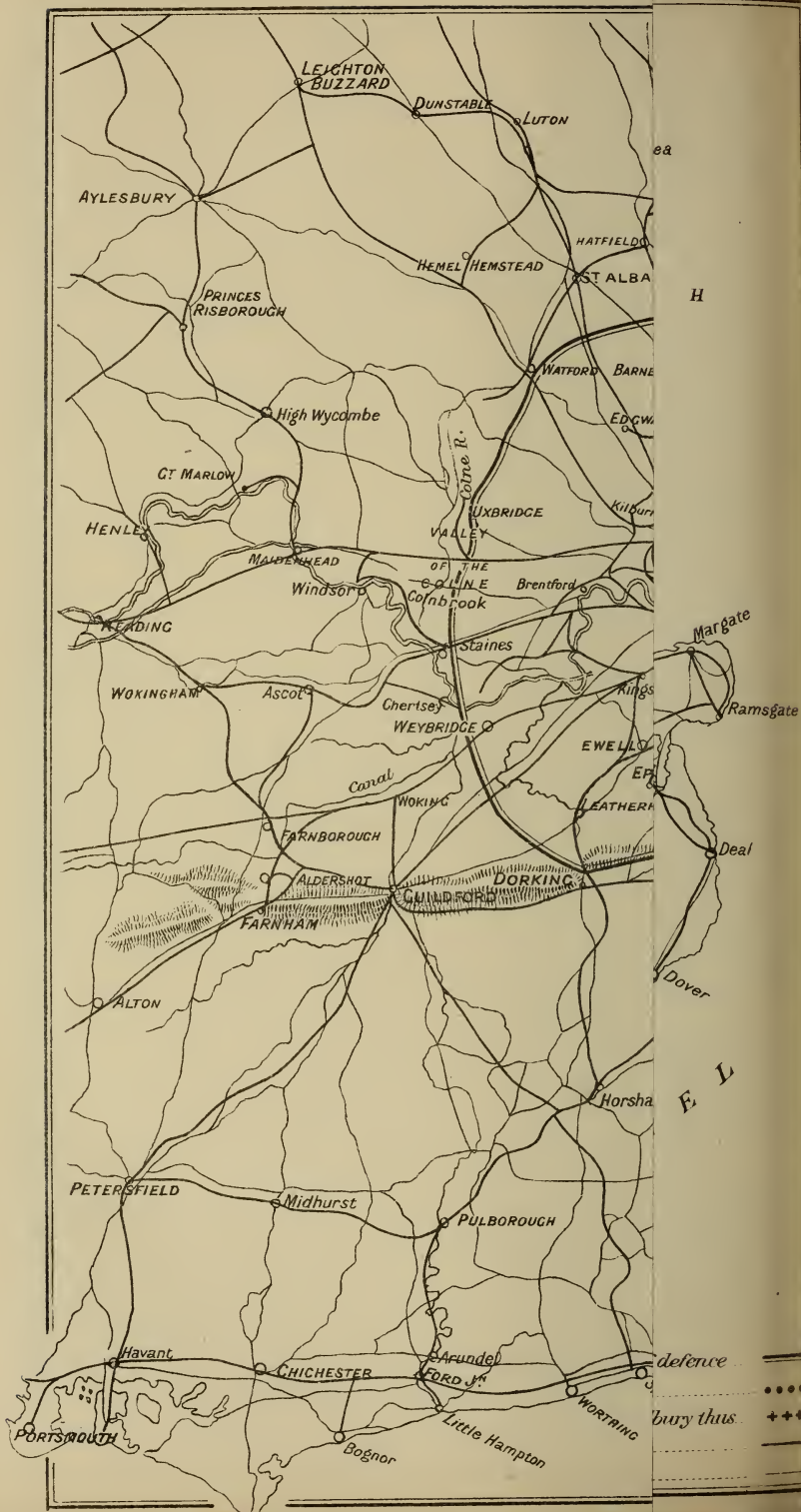
passive and immovable defences for our capital, the enemy will be pretty sure to refrain from attacking it altogether, and by suitable measures, as by harrying our country elsewhere, to force us to abandon our well-prepared defences and attack him in the open. And the more secure and strong we make the fixed defences of London, the more probability will there be of such a result.

To illustrate this point let us assume that by a sufficient expenditure we have fortified London so that its capture by such a reasonable number of troops as the enemy sees his way to bring over is a matter of great difficulty and uncertainty, if not altogether out of the question. What will he do? He will probably concentrate his forces by sea and land for the attack of such a great seaport as Hull and the Humber, making very likely two or three false or threatened attacks elsewhere, that we may be kept in ignorance of his real intention up to the last moment. In the present condition of our defences he will probably take the Humber or any other of our great commercial harbours he may please to select without any very great difficulty. He will thus possess himself at the outset of one of the great seaports of the Empire, striking thereby a tremendous blow at our maritime and commercial prosperity. He will secure himself strongly in Hull, and take measures to enable him to maintain it both by land and sea as a temporary base of operations. He will then proceed at his leisure to march on Selby, Leeds, Bradford, Halifax, Dewsbury, Huddersfield, and all the large manufacturing towns in the district as far as Oldham and Manchester, and to possess himself of them one by one, if we do not oppose him. What are we to do? Can we afford to allow all the manufactures of this vast and most populous district to be ruined, hundreds of thousands of workmen to be thrown out of employment, and they and their families left to starve? I think we may most safely assume that no Government which might rule England at such a crisis could afford to do so. Such an overwhelming pressure would be brought to bear upon any such Government that they would be compelled to do one of two things—either to make peace with the enemy on his own terms, or to meet and oppose his further progress with the whole strength of England. This means that all the defensive works of London would have to be abandoned, and the contest fought out elsewhere.

Are we then hastily to assume that all such defensive works are necessarily vicious and a waste of public money? By no means; the argument only shows that such permanent defensive works, if any are to be constructed, must be considered and dealt with as part and parcel of a large and well-considered scheme for the defence of the British Isles generally, and not as an isolated object.

But the above argument does go to show, and I think to establish, that any defensive measures which we may decide upon as necessary for the defence of London should consist, as far as is reasonably possible, of movable elements, which in case of such action on the enemy's part as the above could be diverted from the more immediate object of the defence of London itself to assist in any operations which our troops may have to undertake elsewhere.





There is another condition which I here propose to submit to and accept as an important and guiding principle in proposed arrangements. It is this: that whatever line of defence we may propose to take up for our field army, it should as far as possible be identical with the line of any proposed permanent works, or outer circle of permanent works, for the defence of the capital. These permanent works can then be added from time to time whenever the money for them is forthcoming, so that instead of constructing another and an interior line of permanent defensive works extra to an advanced fighting line, we should be merely supplementing and strengthening an existing line on one continuous and uniform plan. This arrangement seems to be required for the sake of economy of money, time, labour, and material, and in order that such funds as the Government may from time to time place at the disposal of the War Department may be utilized to the full by being spent on one uniform plan and as part and parcel of a single consistent design.

Lastly, for the sake of economy, we must apparently limit our proposed expenditure in peace as far as possible to those necessary elements which do not admit of being rapidly improvised in time of war. We should lay the necessary foundation in peace, that is which will enable us in time of war to organize a strong defence at very short notice.

I will now explain in detail the scheme of defence which seems to me best adapted to meet these conditions, and then make some further remarks upon it.

(I.) We must first fix upon our line of defence. This the Thames will naturally divide into a northern and a southern portion.

On the south side the features of the ground seem to me to mark out for us the best line to take up very clearly. The elevated ridge called the North Downs, ranging from Chatham on the east to Dorking and Guildford on the west, constitutes a strong natural line of defence, dominating as it does the whole country below for miles towards the south, and giving us almost everywhere commanding and excellent positions for artillery on and behind the brow of the ridge. The slopes in front towards the south are for the most part not too steep to admit of being swept by infantry fire, which is a great advantage. I am aware that other lines of defence nearer the capital have been advocated by high authority; but I feel sure that the more the question is studied and the ground gone over, the more will the advantages of this simple and bold natural line become apparent. At a suitable point on this ridge, at or near Dorking, our line will leave it and be thrown back to join the Thames near Weybridge.

On the north side of the Thames there is no such clearly marked out natural feature for occupation at a convenient distance from London, and in consequence there is much more room for difference of opinion. According to the point of view from which we may approach the subject, different plans involving a greater or less extension of the area of defence will find favour.

If we were to be guided strictly by a search for the most favour-

able ground and put up with grave inconveniences, such as an undue extension of the length of our line of defence, for the sake of it, we shall hardly, I think, stop anywhere short of the line of the Chiltern Hills on the north-west and north of London, and the sea or the coast features immediately commanding it on the east as far up as Maldon at the mouth of the Blackwater.

Although, however, I shall have very much in common with any Officer who will argue in favour of such a line as being our proper advanced line of defence for our field army, I do not here propose it for consideration. I greatly prefer to follow the high authority of Sir Charles Nugent, and to adopt in the main his line as shown on the large diagram. Leaving Weybridge this line passes along the Thames to Staines, and thence to Uxbridge along the valley of the Colne, which admits of being inundated to form a formidable obstacle against attack from the west. From Uxbridge it passes to the railway junction at Watford and thence in a north-easterly direction to the important railway junction at Broxbourne. From Broxbourne it bends in a south-easterly direction to cross the railway between Epping and Chipping-Ongar, and over the valley of the Roding southwards to the high ground on the south side near Havering and Romford; then down to the Thames near the mouth of the Ingreburn brook, adjoining the Rainham station of the railway to Purfleet and Tilbury. Hence Sir Charles Nugent's line would cross the Thames, and pass by Erith in a direction nearly due south to the North Downs range, while I should prefer to trend eastwards along the Thames to a fortified *tête-de-pont*, or circle of forts commanding the passage of the Thames from Tilbury to Gravesend, and thence to Chatham, which forms a fortified bulwark for the circle of defence at the eastern extremity. I prefer this latter course, because Chatham is thus included in the circle of defence; and the forts round Tilbury forming the northern side of the fortified crossing of the Thames will give us a most valuable entrenched camp to flank the north-western line of defence, and threaten the flank of any enemy advancing on London from the north-east coast. The length of this northern line from Staines on the Thames on the west to Rainham on the east is about 30 miles as the crow flies, and considerably more along the crest of the position; and the length of a military road, traced immediately in rear of the entire circle of defence, excluding that portion of it which passes along the Thames, would be about 100 miles, as nearly as possible.

We will now consider the nature of the special defences, whether active or passive, proposed for the occupation of this line, and then the important question of locomotion and transport for getting these into position at the right time.

(II.) A powerful artillery fire is the first requisite for the defence of any position. Forts may or may not be constructed according to circumstances, but the gun-power is essential. And if, as here, we are proposing to dispense in the main with forts, it becomes all the more necessary that we should secure a powerful fire of artillery. We shall entirely throw away the great advantage of our defensive

attitude in enabling us to put powerful guns into prepared positions if we do not take such decided measures in peace as will give us the necessary elements in war for establishing a decisive preponderance over the enemy's guns in the artillery duel at the commencement and all through the fight.

Viewing the urgent demand for our Royal Artillery in India and all over the world, a large proportion of them are certain to be absent. If at the time of invasion an expeditionary force should have left our shores, the number absent will be still larger, and at home a part will be urgently required for such important objects as the defence of Portsmouth, Plymouth, and Dover. Nevertheless, every man and every gun that can be brought together will doubtless be put into the field for the defence of London. But we should on no account stop there.

Not less than 180 powerful guns of position should be ready on the spot and manned by our Artillery Volunteers. No guns of obsolete or semi-obsolete patterns should be allotted to them. The existing 40-pr. Armstrong may have been a very good gun in its day, but it would be much better to assign it to the defence of our forts where there is ample scope for it. Our Artillery Officers in the gun factories at Woolwich are now, owing to recent improvements in guns and powder, in a most favourable position for constructing any required number of powerful guns of position likely to beat any existing guns in Europe of the same class, and far superior to the much lighter field-guns which an enemy would have to bring against them. The new 4-inch breech-loader, 22 cwt., would probably be an excellent gun for the purpose. These 180 guns would be put in aid of all the guns that our Royal Artillery can bring into the field, the number of which we cannot now precisely foresee or determine, as it will vary with the circumstances of the moment. The whole will, however, be likely to give us a decisive preponderance of gun-power. The advantage of this can hardly be over-estimated. The enemy will have the greatest difficulty in bringing his guns into action at all against the powerful shells which the heavier position guns will throw at ranges carefully measured and determined beforehand; and all through the fight our artillery preponderance will tell very heavily against him.

Only 3,000 out of the 38,000 Artillery Volunteers available will be required to man these guns; for this would give 16 non-commissioned officers and men per gun, which is ample. No expense need be incurred for horses in time of peace, or only occasionally for reviews and special training. The guns could be drawn by cart-horses whenever necessary.

The best course will be to give the whole of the guns over, under proper regulations of course, to the London Division of Artillery Volunteers. This is already 3,300 strong, and could then easily be increased, if desired, so as to leave a large margin for casualties and necessary deductions.

Doubtless the objection will be raised—"What, are you going to entrust the finest and most expensive guns of the latest improved

type to Volunteers?" The answer is one and the same all through to all such objections as this. Are we going to double our standing Army and our Militia, including the Royal Artillery? Probably it will be admitted that there is no chance of it at present. Then if so, if we must trust to our Volunteers, let us trust them. No position is more absurd and irrational for the Government and the country to take up than to say, "It is true that our Army is very weak, and that His Royal Highness the Field Marshal Commanding-in-Chief, who is by no means an alarmist, says distinctly that it is not strong enough for its work; but then we have nearly 220,000 efficient Volunteers to support it;" and to say at the same time to the Volunteers, "You are only an irregular force and we cannot trust you with improved modern weapons, though we do not mind letting you have a few second-rate arms of superseded patterns to burn a little powder and make a show with at an Easter Monday review." The real truth is, that there is nothing whatever in the service and management of guns of position, new or old, which our Volunteers are not perfectly capable of learning and of doing thoroughly well for every practical purpose. This they have shown several times already; in fact, whenever a chance has been given them. Let the Government, I would venture to say, trust the Volunteers and deal liberally with them. Let them say to them, "We will supply you with the finest guns that money can buy or science construct—the most powerful guns in Europe. You shall have them locked up in your own gunsheds under the charge of your own Adjutants and Drill Instructors, to drill with as often as you like. We will make special arrangements to enable your Officers and a reasonable proportion of the rank and file to go annually to Shoeburyness or Rye for practical instruction in gunnery with them; and we rely upon you for the defence of London." Who doubts that the Volunteers would respond to such treatment heartily and loyally? They would take the greatest possible pride and interest in these powerful weapons and make themselves thoroughly efficient with them. They would learn to throw up their own batteries for them and construct their own field magazines. Nor would they easily abandon their pets to the enemy. They would stick to them and fight them well, and be an invaluable force. But if any one thinks differently, we need not argue the question. It is sufficient to say as above, that the Volunteers must be so trusted and so employed unless we are prepared forthwith largely to increase our regular forces, or at all events our Royal Artillery.

Such a number as this of guns of position will require a large quantity of heavy ammunition, without which they would be useless. How are we to make sure of its being on the required spot at the right time, in view of the fact that the whole of these guns are to be moved as required to any point on the perimeter of this very wide circle of defence? We ought to construct good permanent magazines at intervals not exceeding 5 miles all round the position. There will then always be a magazine with ammunition within $2\frac{1}{2}$ miles at furthest of any point in our line. Considering that the length of front of the actual battle-field will probably be considerably more

than 5 miles, we shall then be certain to have at least one magazine within the portion of front embraced in the fight, and two more near to hand on the flanks as well. Thus all the resources of three large permanent magazines will be available without going more than a few miles to fetch them. The shells, which are the heaviest item, will be permanently stored there in peace. The cartridges can be added at short notice on the outbreak of a serious war. The question of locomotion and transport for moving this ammunition from one magazine to another, or to any required point of the position with the greatest facility, we will consider presently. These permanent magazines at 5-mile intervals will give a sufficient nucleus of magazine accommodation, and in addition any number of temporary field magazines will be constructed wherever required, when an invasion is imminent or in progress.

I would observe that the present paper, with the remarks above, was written in the autumn of 1884. For the reading of these papers has been delayed for eighteen months, owing to my absence on service in Bechuanaland and other causes. When addressing myself to this subject, therefore, I had not had the benefit of Sir Edward Hamley's most valuable and important article on "The Volunteers in Time of Need," which appeared considerably later in March, 1885. It is now most gratifying to me to find that the views above expressed received strong confirmation and support from General Hamley. I venture to quote a few words from his "Nineteenth Century" article to establish this, and strengthen my position by his great authority. He says: "It would be a most important step accomplished, to complete the step already in progress, of giving these guns (40-prs.) with their full equipment, as soon as possible, into the charge of the Artillery Volunteer Corps, who would use them in action, so that they might be thoroughly practised in the service of this kind of ordnance. Sheds should be built for the guns, stores for their equipment, and magazines for their ammunition, near the destined places of the batteries in the line of battle, which places they should be made to occupy on days of specially complete exercise."

I would also observe in connection with the above, that the views which I am here putting forward generally as to the necessity of a fuller and more complete recognition of the importance of the Volunteers—as constituting at present an integral and most essential part of the primary defences of the Empire against invasion—received strong support from Sir Edward Hamley's well-known article.

(III.) Such a substantial reinforcement of our existing strength in artillery as the above will enable us to await the enemy's distant attack with much confidence. But we shall grossly neglect the great advantage of our defensive position in a country possessing almost unlimited manufacturing resources in aid of scientific war if we do not also turn these to account in preparing a powerful reserved defence to meet the close infantry attack. By "reserved defence" is meant a defence which will remain more or less latent and unobserved by the enemy during the artillery duel and more distant fight, but which will come suddenly into energetic and unforeseen action with

decisive effect at that critical point in the struggle when the enemy's infantry is advancing in force at a close range to storm the position. Recent improvements in the construction of machine-guns give us exactly what we require. Let us place a force of not less than 300 of these in the hands of our Volunteers. The machine-guns should be of the most powerful and serviceable type procurable, whether the ten-barrelled Nordenfelt or the five-barrelled Gardner, or any other more approved pattern. The number of Volunteers required to man them will be 3,000 if we allow ten men per gun. The guns should be fitted with light bullet-proof steel shields, which should be painted brown to resemble the earth of the emplacements as closely as possible. A proportion of the batteries will fire towards the front, especially where required to sweep a special locality as a bridge or a road. In this case they will be masked as well as circumstances will allow and not brought into action at all to attract the enemy's notice until they can fire on this special line with the utmost effect. But for as large a proportion of these machine-guns as the ground and conditions of the case admit of, we should give up any direct fire altogether. They will be arranged to sweep the immediate front of the main position with a flanking fire. Accordingly they will be placed in positions where they will be screened from the view of an enemy in front and from his direct fire. They may be put behind a clump of trees or a group of farm buildings, or a projecting knoll or any other feature which will hide or shelter them. In addition, and especially where no natural cover is at hand, they will be protected from direct fire by being sunk at a low level under the lee of a thick bank of earth thrown up towards the front or on the side next the enemy.

A few of them may of course be disabled by the enemy's random shells before the time of their employment arrives, but it will be very few; for the enemy's artillery will be fully occupied in endeavouring to hold their own in an unequal struggle with our more powerful batteries. When at last the machine-guns open fire, their effect will be decisive. For the ten-barrelled Nordenfelt fires 1,000 rounds a minute, and if only one-third of these guns come well into play at the critical moment, at half speed they will be capable of sweeping the front of the position with 50,000 rounds a minute; that is, they will pour in an overwhelming stream of enfilade fire in aid of the direct fire of the rifles of the infantry. This sudden outbreak will be the first intimation the enemy will have of the existence of these batteries. And when he has discovered them, a considerable proportion of them will be so well protected by their retired positions and by the earthen traverses and steel shields that it will be extremely difficult, if not impossible, to silence them.

(IV.) The offensive elements of our special defensive arrangements come first, and are of much more importance than any measures for a passive defence. But having advocated a powerful reinforcement to our existing strength in the two most important departments of artillery fire against the distant and reserved machine-gun defence against the close attack, we can now afford to turn our attention to these more passive means of defence. Considerable quantities of gun-

cotton and dynamite may be stored in the permanent magazines on the outbreak of war with great advantage. These are invaluable for lightening labour and saving time in clearing the ground for fire or destroying roads, railways, or bridges. General Gordon has recently established conclusively the great value of automatic land torpedoes, and a large supply of them should be kept in the magazines.

Extra supplies of coarse powder and gun-cotton in combination with insulated wires and batteries would also be most useful for laying mines and fougasses at important points in front of the position over which the enemy must pass in force, or where he must place his artillery. There should be in the magazines a plentiful supply of picks and shovels for forming trenches and batteries, woodmen's tools for cutting timber and clearing, sand bags for loopholes and revetments, and iron wire for obstacles.

Our position, or the more purely defensive portions of it, to the exclusion of the offensive zone, will be greatly strengthened by the judicious employment of a large stock of the above materials and tools in the last forty-eight hours before the fight. The points where the brunt of the advancing enemy's attack must fall will then be known with approximate certainty.

(V.) We must now deal with the question of communications from point to point of our extended position. This is a matter of the most vital importance. Even if London were to be defended by a continuous circle of strong forts, a good military road for lateral communication all round the position would be very necessary. But when as here we have given up or deferred the forts as unattainable for the present, and propose simply to take a moderate proportion of the very large number of guns which they would require, and carry these about in the open in the shape of guns of position mounted on travelling carriages and machine-guns, the question of communications for enabling us to move these guns and their ammunition from point to point with the utmost possible ease, so as to anticipate a turning movement on the enemy's part, becomes a matter of supreme importance. In fact the whole of such a system of movable defence as is here advocated hinges upon two pivots—one the establishing the utmost freedom of communication and lateral movement on our own side, including of course the necessary facilities for the rapid transport of guns and ammunition—the other the hindering and obstructing all such movement on the part of the enemy to the utmost possible extent. We shall make sure of being always beforehand with him only by proper attention to these two contrasted and complementary issues. The latter point—the hindering the enemy's lateral or turning movements—we will consider later. Preparations for it can for the most part be left till the occasion arises. But the former question, the opening up of road and railway communication for ourselves, must be dealt with at leisure beforehand in peace. This will be one of the most expensive items in our whole scheme of defence. Whatever plan or system may be adopted London cannot be properly defended without such a provision, so that a large outlay for road-making is inevitable.

But, it may be said, are there not innumerable roads leading in all directions about England already? Undoubtedly there are a good many, but they are inadequate to the purpose here in question, viz., the enabling a General on the defensive to shift his position as rapidly as possible to his right or left, so as to anticipate the flank march of an enemy, and the providing him with good solid roadways whereby to get up his heavy guns rapidly into position in all weathers, and to keep them supplied with the large quantity of heavy ammunition which they will require. For it will frequently be found that there are no roads at all just where they are most necessary; and often the country is wooded and difficult in addition and urgently requires the opening up of wide communications. In view of the importance of the subject I should not quarrel with any Officer who would propose to do the work thoroughly well once for all, by opening up a good military road 100 feet wide all round the whole position. Any Staff Officer who has had experience of the movements of large bodies of troops along narrow roads will appreciate the enormous advantage and importance of such a wide road in rear of the line of defence. A whole Division of all arms could be marched along it without taking up a greater space than would be represented by the length of front which the troops would occupy when facing the enemy in a fair state of concentration. So the flank march of the army would involve no tailing off of long columns. Each Division could retire upon the road, march to a flank along it, and form up again facing the enemy in its new position without any delay, extension, or interference with the march of other Divisions. I do not, however, here propose such a formidable and sweeping measure as the construction of a new military road of this width. Nor do I consider its construction as essential. It will be far cheaper and probably sufficient for practical purposes if a much more moderate sum were to be devoted to improving, widening, and extending those existing roads which form the necessary communications along and in rear of the selected position, and to and from the magazines and nearest railway depôts. New roads would then only be formed here and there where most required. But it will be necessary to secure as far as possible solid well metalled roads along the rear of the position for the transport of the artillery with its ammunition and for stores of all kinds. Also solid metalled causeways or paths should be provided here and there to enable the guns to be got up steep or difficult ground leading up to the artillery positions. These causeways would save much labour and loss of time in getting the heavy guns of position up from the main roads in rear to the batteries, especially in bad weather and over soft and clayey soil. Also good communications are required with the magazines for enabling the heavy shells to be got up from them to the field magazines and batteries with certainty and dispatch.

All these are matters which cannot be improvised quickly in war; whereas free flank communications for the infantry could then be rapidly opened up by the employment of numerous large gangs of civil workmen.

We must on no account omit the allied and equally important question of railway communications. In view of the large existing number of railways leading from the metropolis to all parts of our position, so that there is hardly any point in our line of defence which is more than 4 or at most 5 miles from a railway, I do not propose here any expenditure in the provision of special railway communication. But we must not lose sight of the important question of siding accommodation and approaches to the points where troops and stores would have to be landed from the various existing railways. Also special provision is necessary for dealing with and finding temporary accommodation for heavy goods and stores of all kinds. Otherwise the great value and importance of all these railways will be to a great extent marred and spoilt in war-time for want of such a provision.

Thirdly, in connection with the same question of communications, we must not forget the telegraphs. Although the ordinary civil telegraphs of the country have been greatly extended of late years so that they give us a good basis to work upon, and especially as regards telegraphic communication to and from the metropolis, yet much more will be required to supplement them. We require complete telephonic and telegraphic communication all round the position as well as to and from the permanent magazines and the special sidings or railway depôts.

It seems very necessary that these three questions of roads, railways, and telegraphs should be considered and dealt with as part and parcel of one general question and under one single governing authority. Otherwise much money might be spent to little advantage. Thus it would clearly be of little use that a railway company on receipt of a subsidy from the Government should provide any amount of special siding accommodation to enable men and stores to be landed at a point on its line convenient to our line of defence if there were no road from thence in the required direction. The question of whether such a road exists or could be got by improving an existing country lane, or must be constructed, must evidently be considered and dealt with at the same time as the siding and platform accommodation question. And the situation of our nearest proposed main magazine and its communication must also be considered simultaneously. All these matters could best be referred to and dealt with by a mixed Commission or Committee of Staff, Transport, and Engineer Officers, assisted by experienced civil railway managers or officials from the various leading lines, and from the postal telegraph departments.

It is clearly impossible here to procure any proper estimate of the sums required for these various purposes. It would be necessary that such a mixed Commission as I have suggested, consisting of able and experienced Officers and specialists, should spend months in a careful and deliberate enquiry before they would be able to say where the existing roads are fairly sufficient, where and to what extent they should be improved by widening or remodelling them, where new roads are essential, and where a special outlay on railway depôts or telegraphs is most required.

I propose, however, to allot the sum of 400,000*l.* to these various requirements. It must be understood that it is not here contended that this sum would suffice for all that is desirable or theoretically necessary in these most important matters. But I believe that it would reduce the very considerable amount of work that would still remain to be done whenever an invasion is imminent or in progress to such a moderate and manageable quantity as might fairly perhaps be left to take its place with the rest of the war preparations for defence. The judicious and careful expenditure of such a sum in time of peace would be of enormous value in war. It would give us such a provision of the most necessary road, railway, and telegraphic communication all round our position as would immensely facilitate and go far to secure the proper supply of our troops with all necessary provisions, ammunition, stores, and munitions of war. Also it would provide for an easy and rapid flank movement of the whole force, which is most essential.

Before we leave this part of the subject let me again insist upon its great importance in connection with the allied and collateral question of the decentralization of the supply of stores and munitions of war generally. Our existing system is based upon peace requirements and considers only the most advantageous and economical peace arrangements. I believe I am justified in saying, and that all those members of this Institution who have studied the question will bear me out in saying, that in case of a great war and the invasion of England, calling for the urgent supply of arms, ammunition, equipment, warlike stores, and provisions of all kinds on an enormous and unprecedented scale, we are in danger of the most hopeless and ruinous block and confusion.

We may have such a scene of disorder as will rival or eclipse the memory of the block of stores on the French railways in the Franco-German war. There, as is well known, miles of trucks, loaded with every necessary and unnecessary description of stores, blocked the large siding accommodation of the French railway depôts, and no one had the slightest notion of what was inside them. So that Officers in command of troops close by were sending the most urgent and despairing telegrams to headquarters for these very stores, in order that still more truck-loads of them might be dispatched, only to increase and multiply the existing confusion.

In case of England being involved in such a great struggle, it will clearly be impossible for the Commissary-General at Woolwich, with his staff, to attend properly to the urgent telegrams in connection with the supply of stores, which under our over-centralized system will pour in upon him by the hundred from all quarters. For wherever the British flag flies all over the world, urgent requirements will then develop themselves.

It is in view of such considerations as these that, starting with the idea of spending the least possible money, and making the most modest possible demands, I have yet been led to propose the expenditure of a large sum, more than half my total estimate, in the provision of well-appointed magazines, wherein all necessary ammunition and stores are to be permanently stored at short intervals all round

the selected position; also in opening up good communications whereby the rapid supply of these necessary munitions to the troops and guns who are to use them is provided for, and in the provision of a good substantial basis of road and railway accommodation and transport, whereby the supply of the army generally and its rapid flank movements in any direction will be facilitated and ensured. I now invite your consideration of the absolute necessity for these proposed arrangements.

Given the men and the powerful force of artillery and machine-guns, and a good supply of ammunition and all necessary tools and stores for organizing a strong defensive position actually on the spot, ready to hand, with flank communications well provided for, and there is not a General in the British Army who will not see his way to make a good defence, and meet any possible invader in a cheerful spirit. But our ablest Generals will, it is to be feared, assume the responsibility of command at such a crisis with a heavy heart when they know that long trains of ammunition have to come from a distance over roads or railways already fully occupied with the transport of troops and necessary provisions, and have then to be hauled across country with infinite labour and delay to the batteries and trenches; when they know that the reserve ammunition for a second day's fighting may or may not be forthcoming, and that when, after infinite pains and trouble, everything has been got together for a good defence at the threatened point, it is very doubtful how far, in case of a flanking movement of the enemy, they themselves will be able to move and to organize a defence elsewhere.

I submit, therefore, to your judgment that whatever be the exact position which it is desirable that our field army should occupy for the defence of London, and whatever view may prevail as to the necessity or advisability of fortifying this position in a regular way, this point at least is perfectly clear, that the preparation now in time of peace of such arrangements as I have indicated above for the supply of ammunition and warlike stores of all kinds, and for rapid transport and free communication in time of war, is a matter of the very first necessity.

(VI.) Let us now abstract for convenience an estimate of the approximate cost of these proposed arrangements. This is as follows:—

Permanent Works.

| | |
|---|----------------------|
| Twenty magazines at 5,000 <i>l.</i> | £100,000 |
| Road-making and road improvement, including forming permanent dépôts on the nearest railways, with special siding accommodation, also telephonic and telegraphic communication to the magazines, and along the position | 400,000 ¹ |

¹ I observe in passing that this 400,000*l.*, most of which would be spent in road-making and road-improvement, represents a most valuable resource for providing useful and important public work for our distressed operatives in severe winters. If all the necessary plans were drawn out in readiness, how could 400,000*l.* of public money be spent to better advantage than in alleviating such a season of distress as occurred last winter by providing this work for them?

| | |
|--|----------|
| Brought forward | £500,000 |
| Movable munitions of war: 180 guns, new 4-inch breech-loaders, complete, except horses, with 100 rounds of ammunition per gun, and all necessary stores; 300 powerful machine-guns complete (except horses), with 10,000 rounds of ammunition per gun, and all necessary stores. Supply of stores for the magazines, namely: Sandbags, entrenching tools, artificers' and woodman's tools, iron wire, iron gabions, gun cotton, land torpedoes, electric mines, and miscellaneous small stores | 400,000 |
| Total | 900,000 |

I would observe on the above table, that I have increased my original estimate of the cost of stores and munitions of war for the magazines, in view of the immense advantage, from the point of view of our national defences generally, in having these twenty magazines all round London, and in easy communication with its network of railways, well supplied with such stores. For so long as we have no central nor second arsenal to assist, or if necessary take the place of Woolwich, and assuming that I am not altogether mistaken in my views above as to the probable congestion and block in supply of stores and munitions of war likely to be created by the exigencies of a great national emergency, it is clear that the existence of these twenty well-filled magazines would be of the utmost value, quite apart from the direct defence of London.

Thus suppose, instead of marching immediately on London, an enemy were to land somewhere in the north or west, and force us by his ravages to take up a position at some convenient point far from London, to stop his progress. A large issue of these most necessary stores could then at once be made from those magazines on the north or west side of London which are nearest to the required railways. These would be forwarded forthwith in aid of the local resources of the military district in question. They would then be replaced from Woolwich at leisure. The saving of time by this course might easily be of the most vital importance to the defence. For this and for obvious reasons of convenience it will be well that some of the magazines should be placed as near as possible to and in close connection with the special sidings to be formed on the leading railways, and these magazines may with advantage be larger and better filled than others. The estimate for their construction might be increased to 6,000*l.* or 7,000*l.*, the extra sum being saved for them by a reduced expenditure elsewhere.

I have included no small arm reserve ammunition in the magazines in peace, since it would deteriorate. But a large supply should be forwarded to them immediately on the outbreak of a serious war when invasion seems possible.

It is hardly necessary to call attention to the smallness of this sum of 900,000*l.*, as compared with the enormous magnitude of the interests at stake. Viewed as a question of insurance to the property and

trade of London, it is an extremely moderate amount. But when regarded, as it should be, as a necessary insurance on the wealth and trade of the whole British Empire, and on the welfare of all the millions of people who compose it, it is altogether and absolutely insignificant.

(VII.) Having now, as I venture to think, laid such a foundation in time of peace as would enable us to organize a very powerful defence at the shortest notice in war, let us next proceed to consider whether any special measures should be taken for strengthening and improving these defences by temporary or provisional works to be constructed rapidly whenever the occasion may arise. These works would be extra to and beyond the ordinary field works or measures necessary and usual for establishing a defensive position. I am very strongly opposed to trusting the defence of London in any large degree to special provisional works to be thrown up under the tremendous pressure and amid the confusion and disorganization which it is to be feared may prevail during an invasion or attempted invasion of England. For such over-pressure and confusion will be only the natural correlative and consequence of our present state of supineness and unpreparedness in these matters, and are therefore to be expected. Nevertheless, it does not follow that given such a substantial nucleus or basis of defence as I have endeavoured here to advocate, provisional works thrown up on the outbreak of a serious war will not come in as a very valuable adjunct and auxiliary. I submit that they will, provided we frame our scheme for them in accordance with the following principles which seem to me to be essential. These are—

(a.) The works should be of the most moderate and manageable dimensions admitting of very rapid execution by gangs of civil workmen.

(b.) They should be of the utmost possible simplicity of design and construction, so that any contractors' foremen or overseers who may be employed in charge cannot well go wrong in them, and will require only a minimum amount of skilled supervision.

(c.) The works should be adjuncts and auxiliaries to rather than an integral and indispensable part of the general scheme of defence, so that the position will be complete and perfectly defensible without them, and no confusion or disorganization will be caused by their absence if after all from any cause they should not actually have been completed in time.

(d.) The plans, the bills of material and quantities, and every detail connected with the construction and proposed arrangements for the execution of these works should be carefully drawn out in peace and printed or lithographed in a convenient form for distribution and reference.

(e.) Provisional contracts based upon the information so supplied should be drawn up and signed with the most substantial and trustworthy firms of contractors and large employers of labour whenever a declaration of war is imminent or immediately upon it. On receipt of an order by telegraph to go on these firms can then proceed forthwith with the execution of the work without the loss of an hour.

If these conditions are adhered to, and the whole affair reduced to the simplest elements on the most moderate scale so far as any individual contract is concerned, we shall ensure, so far as can reasonably be ensured, that the works will be finished in time. And even if from any cause they are not then forthcoming our defensive position will not be crippled or marred by their absence.

To meet the above conditions the best form which our provisional works can assume would be, I think, as follows:—

(a.) Powerful blockhouses or caponiers should be constructed in front and immediately under the fire of the main position. These would allow us to place some of the machine-guns which we have already provided in secure and commanding positions, stronger than but similar to the slighter and more temporary field constructions which have been advocated above. These caponiers would entirely give up direct fire, otherwise they might be knocked to pieces by the enemy's field-guns. Their general and typical form would resemble the letter T, the head of the T representing a thick bank or traverse of earth parallel to the general front, and quite impervious to the enemy's shells, with an easy slope towards the front and a strong revetment of stout timbers in rear. The body of the T represents the caponier proper, traced at right angles to the general position so as to sweep the front with a flanking fire. It would be at a low level under the lee of the much higher earthen traverse, which would project well beyond it on each side to secure it from oblique fire. It would consist of large logs and rifle and shrapnel proof steel or iron plates with a roof of thick oak logs or railway bars covered with earth, and impervious to the enemy's shells. These caponiers would be screened from the enemy's view as much as possible by being placed behind woods, buildings, or other cover in addition to the direct protection afforded by the earthen traverse. They might be surrounded by an obstacle such as a good wire entanglement to prevent the enemy closing on them. They would mutually support and flank each other, as each would sweep the immediate front of the next and the obstacle before it, at an easy and effective range. They would not come into action at all until the enemy's infantry advances in force to storm the position. They would then suddenly open upon him a flanking and oblique fire with the most deadly effect.

The only case in which they would undertake any direct fire on the advancing enemy would be as before in a few places where it might be desirable to sweep a special locality such as a road, bridge, or causeway leading on to the position. They would then be carefully masked and blinded and reserved for this particular purpose. So they would not open fire till the latest moment, when they could do so with the most effective result on this special line.

It will be impossible for the enemy to pass this line of flanking caponiers as long as the machine-gun fire from them remains effective. And they will receive such efficient protection from the high traverses in front that it is extremely difficult to see how he is going to attack them.

He cannot close on them without surmounting the obstacle under

a torrent of fire from the collateral caponiers on each side as well as from the artillery, machine-guns, and infantry on the main position in rear, where special provision should be made for concentrating an overwhelming amount of fire on and around each caponier for its protection.

They would be further strengthened in most situations by cutting a ditch around them to prevent the enemy from closing on them in case he surmounted the obstacle. Or the ditch could be placed under a wire entanglement as part of the obstacle.

Before we leave this subject I would express my conviction that this whole question of reserved defence—by aid of machine-guns reserved for flanking and oblique fire only and well traversed from the enemy's artillery—is very important and admits of great future development. I venture to predict that that Power in Europe which first grasps its true importance, and adopts a good system for turning it to account, whether by means of hasty field constructions or by provisional works, will be likely to gain a very marked success in defensive warfare.

(b.) Any further expenditure of money and means on provisional works I should propose to apply to constructions of a larger and more elaborate character placed neither in nor in front but in rear of the firing positions or main line of defence, whenever the ground may favour such a position. Here a row of strong redoubts might be constructed if time permit. Just at the moment when after a long struggle and very severe fighting the enemy has, we will suppose, succeeded in forcing all our front line of defences, and arrives pretty well exhausted on the crest of the position, he will then find a line of strong works in front of him. These being retired for the most part behind the crest of the main position will not have suffered much from the enemy's artillery in all the first part of the fight, and will be in good condition. As he cannot pretend to pass them without bringing up a strong force of artillery to silence them he must necessarily come to a halt, and time will be given to bring up reserves, to re-form the defenders in rear of the redoubts, and to renew the fight with their powerful support. This arrangement would be better, I submit, wherever the ground is fairly favourable to it, than the placing the redoubts in the front line where they would be a target for the enemy's guns all through the day, and where the length of front which they would occupy would be better allotted to the usual open batteries for the guns and to trenches for the infantry. And more especially we should thereby avoid any chance of being caught by a rapid advance of the enemy in the middle of their construction when they would be prejudicial to the defence. For a line of good completed batteries and trenches of the usual field profiles are far better than a set of half-finished redoubts.

(VIII.) We will now say a word upon the question of time for the construction of such works as these.

And here a very important consideration comes in, which I have already alluded to in the first part of this paper, and to which I again invite your special attention.

It is this, that the more complete our preparations in peace may be, the more time we are likely to obtain to add to and strengthen those defences in war. For as our defensive preparations become stronger, the stronger the force which the enemy must send against them. And from the conditions of the case, and especially from the over-ruling necessity for sea transport, the stronger the force which the enemy has to send against us the more time we shall be likely to gain before he can actually appear in front of our position. This consideration applies to every stage of the question of invasion, but as I have above pointed out it comes in with special force at the point at which any possible enemy is obliged to give up the idea of capturing London by a *coup de main*.

This point of security I believe that we have already fully reached by that amount of peace preparation which has been advocated above, quite apart from and independently of any aid from these provisional works, whether small or great. But deferring any discussion of this point, it is undoubtedly safer to arrange to strengthen our defensive position if required with some works at least which can be executed in time for any probable contingency. Hence the first description of provisional works above—the flanking caponiers in front line. These are so extremely simple and easy of construction that I have no doubt that plenty of substantial firms could be found to contract for the construction of any reasonable number of them within a week from the order to commence, under stringent guarantees against exceeding this time. Whereas under no circumstances that would appear to be reasonably possible would less than ten days or a fortnight be available.

I must here, however, digress for a moment to say that I am assuming that to meet such a serious war, instant and decided measures will be taken to secure the portion of the coast between the mouths of the Thames and Medway on the south and Harwich on the north, including the Blackwater. This question will be considered in my next paper. I will only observe now that if this portion of our coast be neglected, the enemy may be in London before we have time to think about provisional works or anything else. But assuming for the moment that it must and will be attended to, we ought then under no probable circumstances to secure less than the ten days or a fortnight above for organizing and completing our defensive line with its provisional works. This will amply suffice for the flanking caponiers, but not for the redoubts. The time required for the latter will, of course, depend mainly on the exact profile and construction adopted, as they may be given any section from a field work capable of being completed in three days up to that of a first class fortress. Provisional redoubts of only moderately strong profile are what I have here in view. They should be large and roomy, well supplied with powerful artillery and numerous machine-guns, so as to make up in volume of fire for their deficiencies in strength of profile. They could probably be constructed and armed in a month or six weeks according to the ground and the circumstances of the case, provided the designs and special

arrangements for the most rapid construction are carefully worked out beforehand, and provided the work be pushed on continuously day and night from commencement to finish. We cannot reckon upon them to meet any sudden attack, nor are they necessary for the purpose. But they will in all probability be ready in time for those more leisurely and extensive operations on the enemy's part which, if the views above put forward are sound, our first established line of defences will have forced upon him. In proportion to the strength of these secondary defences again the scope and magnitude of the enemy's operations must be enlarged, his transport in artillery, and shot, and shell, especially will be greatly increased, more time will be gained to strengthen and extend the defences on our side, or to establish a second or inner line of defence in aid of them on the threatened quarter.

(IX.) With such arrangements as I have advocated for preparing leisurely in time of peace the most indispensable elements and conditions necessary for enabling us to complete very rapidly in time of war a strong line of defence for London, and further with well-matured plans for strengthening this line by provisional works whenever the occasion may arise, it would apparently become a question very open to argument whether the permanent fortification of our capital may not be dispensed with altogether. At least it might be deferred until many other pressing requirements in connection with our defences, whether naval or military, have been attended to. These questions will be discussed in my next paper. But I ask you particularly to note that there is nothing whatever in my proposals to interfere with the proper construction of a line of permanent works whenever the money may be forthcoming. On the contrary, every penny which would be spent now in time of peace, supposing these suggestions were carried out, would be so much to the good, and would represent so much useful work done towards, and in connection with, the permanent defences.

For the powerful guns of position and machine-guns, which it is here proposed to provide, would be the very things of all others which would be the most required for the defence of the long intervals between the forts, and to supplement and support these permanent works. And the magazine accommodation and special provision for communications would be most necessary and important in any case, and whether the forts are to be constructed or no. Instead, therefore, of being in any way antagonistic to, or interfering with, the permanent fortification of London, whenever the Government may recognize its necessity, my proposals may rather be regarded as leading up to, and paving the way for it. Meanwhile in the present they provide us with a strong defensible position, calculated effectually to prevent the capture of our capital by any force which an enemy could reasonably undertake to run across the Channel and march rapidly upon it for the purpose. And in the future they provide us with a solid basis of defence capable of being supplemented and strengthened hereafter by suitable works, whether provisional or permanent, to any required extent.

(X.) I would now invite you to consider the leading tactical idea on which my whole scheme of defence is based, with a view to examine its soundness.

It is a maxim of the greatest master of modern warfare, Napoleon, which Captain Mayne, R.E., has wisely adopted as a motto for his valuable work on infantry fire-tactics, that "fire is everything, the rest is of small account." We shall entirely throw away the one great advantage of our position on the defensive on our own soil if we do not take the most decided measures for establishing and maintaining a decisive superiority of fire all through the fight. This idea should dominate and govern all our arrangements; and if we will only carry it out thoroughly and consistently, utilizing our great resources as required for the purpose, it is bound by every reasonable calculation, and so far as human foresight can go, to secure us the victory.

Let us take then this idea, that we must before and beyond everything else seek to establish and maintain a decisive superiority of fire of every kind throughout the fight as our guiding star, and see what it means, and whither it leads us.

It leads us to the occupation of a position forming part of a continuous circle of defence round London, such as has been detailed in the first part of this paper, because in no other way can we make sure of having on the spot at the right time the necessary array of guns and ammunition required for such a superiority. It leads us to the armament of this position with a special local force of guns of position and machine-guns to give us a decisive preponderance of fire in the two critical and all important periods of the artillery duel and the enemy's close infantry attack. It leads us to the establishing now in peace of good permanent magazines at moderate intervals all round the position to be filled with the necessary ammunition and stores. In no other way, as I contend, amid the turmoil and confusion of such a crisis, and viewing the immense pressure certain to fall on our Store Department, can we make quite sure that the large supply of heavy ammunition which will be necessary will then be on the spot. It leads us to the storage in these magazines of a large reserve small-arm ammunition supply, so as to ensure that in a protracted and desperate struggle our troops will never fail of an abundant supply of ammunition. It leads us to the opening up of good communications to enable these guns and this large supply of ammunition to be moved as required from point to point of our extended position with rapidity and certainty. For I should give our troops not less than 500 rounds a man, and sweep the ground in front with a storm of bullets from the time the enemy comes within the extreme range of the rifle. Let us use every known method and precaution to ensure that the ammunition shall be expended to the best advantage, but let us fire away. Only let the bullets go to the front, and a proportion of them depending, do what we will, very largely on the general law of averages, must and will find their billets. Thus you will see that, viewed in the light of this ruling principle, the leading arrangements which have been proposed for the occupation of the position are fully justified.

And I now submit to your judgment that they are sufficient. I am not careful as to the exact number and nature of guns or machine-guns which are to be employed. These are debatable matters of detail. All I contend for is, that whatever number of such weapons our most experienced Officers may decide upon as necessary in addition to those we now have available, in order to give us a decisive superiority of fire over any number which the enemy can reasonably be expected to bring into the field against us, those weapons should be actually in the hands, either as has here been suggested, of our London Artillery Volunteers, or of some other troops. And the ammunition for them should be actually on or near the spot, so that we may be quite sure that it will be there when wanted.

If this be done, consider the position in which the enemy will be placed. He will have to advance against a formidable commanding position under a tremendous fire of large shrapnel from numerous and powerful guns of position firing at known and measured distances from the moment he comes within their range, or, say on a clear day, 4,000 yards. This shell-fire he cannot reasonably expect to silence or to cope with effectually with his much lighter field-guns. He then has to advance in the open well in view of a high and commanding position, over cleared ground, under a tremendous hail of long-range fire from our infantry posted behind earthworks, and supplied with practically unlimited ammunition. To this his moderate supply of ammunition will alone forbid his replying to any purpose. When he advances to the close attack with decimated troops who have already been under a heavy and continuous fire for at least 2,000 yards, he will be met not only with a hail of lead from our entrenched infantry and machine-guns firing directly, but with a steady stream of flanking-fire from machine-guns firing from protected emplacements under the lee of thick traverses which effectually screen them from his artillery. Without reckoning any aid which we may derive from well-known auxiliary defensive appliances such as mines, land torpedoes, obstacles, &c., if we cannot hold our own in a position so armed we can hardly expect to hold our own anywhere at any time.

Is the struggle then to be purely defensive on our side? By no means. We should regard all this multiplication of defensive power as merely paving the way for and leading up to a vigorous offensive. To this end we ought to keep our best trained and most mobile battalions massed together by strong brigades, Divisions, or even a whole Army Corps if you will, ready to assume such an offensive whenever the right moment may arrive. The one great advantage of our strong defensive position, unlimited supply of ammunition, and multiplication of defensive or retaining power generally, will be that these will enable our lesser trained or almost untrained troops to hold their ground, and bring the enemy's progress to a standstill, over large sections of the position, while elsewhere we shall have our best trained troops kept well in hand for counter-attack on the largest scale.

(XI.) Moreover I contend that such a scheme of defence as this is in harmony with and follows naturally from a consideration of the

essential conditions of our position at present as compared with other European Powers. Their strength lies in enormous numbers of men, the result of enforced conscription. With us trained men are scarce and dear, but we lead the world in manufacturing capabilities. What folly then not to set ourselves to atone for our acknowledged weakness by utilizing and developing our acknowledged strength! We ought to multiply power, if not in men, then at all events in first-rate guns, machine-guns, and appliances of all kinds.

(XII.) Lastly, I ask you to note that the idea which underlies all these proposals is that of dealing with this great question of the defence of our metropolis on the principle of "*solvitur ambulando.*"

Only let us make a beginning, a fair start on a well-considered and comprehensive plan, and the difficulties will vanish one by one as we proceed, and the whole question tend to work itself out to a satisfactory conclusion. For let us suppose for a moment that the expenditure of such a modest sum as has been advocated above, under a million sterling, were approved of. The careful study of the ground all round London, and the laying down of a definite and authoritative scheme of defence which its due expenditure would involve, would alone be of the utmost value. The general line of the position having been once fixed upon, its proper disposition in detail would be systematically worked out both theoretically and practically. The different sections of it would form an admirable theme for the most talented young Officers, whether at the Staff College or elsewhere, to study and report upon. The actual occupation and putting into a state of defence of successive portions of it would form a most practical and instructive programme for our Volunteers to work at, or better, for mixed divisions of all arms of the Service to attack or defend at successive autumn manœuvres. A small number of the provisional caponiers, or blockhouses, could be constructed from time to time at important points, in connection with the manœuvres, sufficient to establish practically the best design and most rapid construction for these works. The all-important question of the best means of meeting a turning or outflanking movement on the enemy's part, which we shall revert to later, could be well studied for each different section at such autumn manœuvres. By degrees and by such combined theoretical and practical studies on the ground, the exact circumstances and capabilities of every portion of the position, its strong and weak points, and the portions and particulars requiring special attention on the outbreak of war, or a further moderate outlay in peace, would be thoroughly well worked out.

Any General Officer who might suddenly find himself called upon to assume the tremendous responsibility of defending London against an invasion would then, I contend, find himself in a position out of all proportion more favourable than at present. He would find ready to his hand a well studied and well understood position, special railway sidings and roads suitably disposed for getting his troops and stores conveniently on to it, telegraphic and telephonic communications everywhere round it, good permanent magazines at short intervals all along it, containing cartridges, shell, small-arm reserve ammunition, tools,

stores, and every necessary auxiliary appliance for establishing a strong defence. He would, find in addition to the arms at present available, a most powerful special force of splendid guns of position well supplied with ammunition wherewith to overpower and silence the enemy's artillery, and a formidable array of the best machine-guns for establishing a strong reserved defence against their infantry attack. He would find Officers of his Staff already well acquainted with the position, troops previously practised and handy at the necessary works, and a host of skilled civil workmen ready to execute auxiliary works of defence on simple and well understood designs as well as to assist as required in the opening up of roads, the rapid construction of strong emplacements for the guns of position, clearing the ground for fire, or any other necessary preparations.

It is, I submit, beyond all reasonable question that with such advantages as these, so strong a defensive position would be established that no enemy could afford to run the tremendous risk of attacking it with such a force as he could pretend to run across the Channel for a sudden attempt.

But if abandoning the idea of a *coup de main*, a more leisurely and deliberate attack is to be made with much larger forces, and with a much greater concentration of guns, materials, and appliances, then the conditions are still all in our favour. For in gaining thereby the one indispensable element of time we gain everything. As the enemy multiplies men, means, and appliances for the attack, so shall we multiply them for defence, and in a greater ratio. For he has to bring everything across the sea subject to unknown risks thereon. We have lost the command of the Channel indeed, but as long as we have a fast steaming vessel of any sort left, and a bold crew, we can attack his transports. And we have all the enormous resources of London, the capital of the world, immediately in our rear, and all the highly concentrated power of England in direct and immediate communication by railway and telegraph wherewith to fortify and man our position. And so the invasion of England and capture of London will work out step by step to a larger and larger affair, requiring more and more expenditure of men, money, means, and time, and giving us on our side more and more scope for turning our vast and highly concentrated resources to account. In fact the struggle will tend rapidly to resolve itself into the question of whether the whole strength which an enemy can undertake to bring across the sea can contend with the whole strength of England on our own ground. This is all we require and all we ask. For once let the great latent strength of England be brought fairly into play and we have no fear for the result. To secure this we ought now, by a most moderate immediate expenditure in time of peace, to lay at least such a sufficient basis and nucleus of defence as will secure our capital against a sudden attack and pave the way for further defensive measures when required. And I once more call your attention to the all-importance of this as being the indispensable groundwork and cardinal necessity at present. For without it we have absolutely no security whatever that, at some crisis favourable to an invasion, we shall not see all our

defences turned, our capital captured, and the British Empire ruined by one sudden and bold stroke, before we have time to bring our great latent resources into play.

The CHAIRMAN: We are favoured this afternoon with the presence of an Officer who has had very much to do with this matter. I refer to Sir Charles Nugent, who perhaps will be good enough to favour us with some observations upon this very valuable paper.

Colonel SIR CHARLES NUGENT: Sir Andrew Clarke, ladies and gentlemen, possibly I should not have said anything on this subject had not the lecturer said that this is my map, and that that double line is the line I propose for the defence of London. In one sense this is true, but the double line does not represent all I took occasion to propose when I prepared this map, for in my project for the defence of London I included certain arrangements for the defence of Tilbury and the defence of Chatham, and I held the Thames with armed strength both above and below London. Of course the object of rising in this theatre is discussion, but on this particular subject I would rather deprecate discussion. It is possible that I and others here may not agree with all that the lecturer has said as to the scope of invasion. We may think, perhaps, that there is not sufficient distinction between a mere dash at London and an incursion, however sudden, with a view to subsequent and more prolonged operations if the incursion proved successful, or to a general and deliberate invasion. I may say generally that I agree with the lecturer as to preparation in time of peace; I agree with him as to decentralization, and as to the establishing communications. I agree with him in making certain arrangements for the provision of ammunition of all sorts. But with regard to the general line which is fathered on me I would only say this,—disclaiming that I am any authority,—that I have spent the intervals of a good many years upon the defence of London and of the coast. I have walked all round this position over and over again, and indeed I have walked at intervals along the whole coast from Harwich to Portsmouth; there is, however, an Officer here who, I believe, shares pretty much the same view of it as I do, and who has spent even a great deal more time on it, I mean Sir William Crossman; and although in my own mind I may be convinced that that is the best position, that no one particular position is an absolute necessity, that you may make, by the manner in which you treat it, one position as good or nearly as good as another, and so without at this time pinning myself to any particular position, and without giving reasons or mentioning what accessory things I consider necessary, I think the lecturer has done good service in calling attention to the necessities for defence of London. So much for the theoretical aspect, ladies and gentlemen. Now I would like to say a word or two upon the practical aspect of this matter. If I may venture to predict, following the example of the lecturer, I would predict that—I mean no disrespect to you, Sir—when it is all over the Chairman will get up and will say, “Well, ladies and gentlemen, we have heard a very interesting lecture, ah, a very interesting lecture indeed! It is impossible to exaggerate the importance of this subject. I think, ladies and gentlemen, we had better give a cordial vote of thanks to the lecturer;” and we shall give it. This will happen again next Friday, and then we shall go home and shall feel satisfied, with a virtuous satisfaction, that we have done our part—that there is an end of it. But have we done our part? Is there an end of it? Shall we not be rather in the position of the man who said he would and didn’t? Really when I reflect on the numbers of occasions, here and at other places, on which I and others have advocated this defence of London, I feel somewhat in the position of a man, I grieve to say it, who has lost the fight, though I cannot say like the proverbial man who loses the fight that I come up smiling. When I think of the number of times that this has been repeated, I cannot help thinking what an idiotic fool John Bull is; people say it is part of our Parliamentary system. I am not going to talk politics, Sir; politics are wisely prohibited in this Institution; but I may ask you, ladies and gentlemen, and I do ask you, can anything be more idiotic than the mode in which we administer military and naval affairs? This lies at the root of this matter. Why, I can recall nothing but alternate hot fits of expenditure and cold

fits of economy, and what is the end of it? Do you think it leads to efficiency? Do you think it leads to economy? It leads to drifting, waste; it leads to inefficiency, it ends in a policy of "let it alone." But is this the end? The lecturer, perhaps, in the next lecture will tell us what the end will be. In considering the composition of the War Office, an outsider might reasonably expect that its three or four well-paid official chiefs should know something about military matters. He might not unnaturally think, "Oh, this official must be a General, and he of course knows all about guns, and drums, and wounds;" but what is the actual fact? Exactly the reverse; and I ask any man who has had any experience of the War Office for the last fifteen or twenty years, how many Secretaries and Under-Secretaries of State or Surveyors-General have got into their places—places in which they could do unlimited good, but in which also they may work irreparable harm—as a consequence of their special knowledge or ability? Would they have been in them had it not been for their connections, or would they have been in them had it not been to satisfy the interests of party? I recollect in this theatre when discussing the question of Colonial matters, and having to consider the action thereon of the Colonial Office, an Officer who was present made a remark which impressed me as very sensible; he said, for his part he would never have a Secretary of State for the Colonies if he had not seen something of the Colonies. And so say I with regard to the War Office. It is all very well to fall back upon the dual government of the Secretary of State for War and the Commander-in-Chief, and imply a responsibility upon the part of the latter which is not his; this lands you in absurdities. There should never be a Secretary of State for War or officials alongside of him who do not know something of their business. Again, let me refer to the Admiralty. I am not saying anything about this or that side of government, nor am I reflecting upon individuals, I am criticizing the system which prevails in our benighted country. What is there in the Navy which differs in essentials from the Army? Both use the same guns, both use the same locomotive power. Sailors are men as are soldiers, of the same flesh, and nourished with the same food. Tactically the same system is employed; why should the system of administration be different? At the Admiralty there is a Board. Is a Board the right thing? Then let us have a Board at the War Office. If on the other hand the Secretary of State, one-man government we will say, is the right thing, then let us have one-man government at the Admiralty; one or other must be right, both can't be right. Can affairs prosper when administration is in such fashion? They cannot. It is all very well for Major Elsdale to come here and lecture; what comes of it? Nothing, because the official mind takes no heed. The Services are one, and but one, of the battle-grounds of party government. What does party government for us? What has it done for us? We may well say what. Look to a neighbouring island and you shall indeed in sad sooth see, in the result of the long season of restrictive and sentimental policy, *one* of the results of party government; and to-day's paper, with its accompanying discussion, will go abroad, and talk here as you and I may, nothing will come of it; talk we ever so wisely, nothing will come until we change this party system of England, and we can do it, mind you! There are many of us now under the new regulations who have gone or are going into private life. There are many, not the worst, of both Services with nothing to do. As a large and very increasing body, and yielding in patriotism to no other, we ought to make our voice heard in Parliament; we can combine to force our views on the electors, and we should. I (and others better than I before me) have been fifteen years engaged upon this matter of deference, and here to-day we are as we were fifteen years ago, and some of you, I fear, will see that period lengthened twice or thrice if we do not put our shoulders to the wheel and show ourselves thoroughly in earnest.

Captain C. B. MAYNE, R.E.: Sir Andrew Clarke, ladies, and gentlemen, I should like to say a few words in opposition to the principle underlying Major Elsdale's able paper, the necessity of fortifying London before anything else is done. The fortifying of London is certainly an important point, but the question is, whether it is the main one? I have read a great number of papers and books on the defence of the kingdom, and what has struck me more than anything else is the way in which ideas crystallize around a single town, though the chief one of England, as if London was England itself. The only exception to this rule was the

Defence Committee of 1859, who pointed out that the fortifying of London was a secondary consideration to that of fortifying our naval arsenals and dockyards, as without these the defence of the kingdom was paralyzed, even if London held out, while with them the defence could be carried on even if London fell. This principle still applies, but none of our naval arsenals and dockyards are in a condition to resist a land attack, Chatham being totally undefended; and Portsmouth, Plymouth, and others incomplete, either in forts or guns or both, or in ammunition. Our rich commercial ports all along the coast are all open to attack by cruisers, and the French have given us fair notice of what they intend to do, especially Admiral Aube, now their present Minister of Marine, who has openly said that the French are "going to attack all our coasts if they have war with England." Another reason why the fortifying of London is a secondary consideration is, that all past history shows that in national wars the conflict has been decided by the defeat of armies in the field, and not by the capture or cutting off of the capital. The same applies to England. We first want an army sufficient in numbers, efficient in discipline, and complete in artillery, cavalry, transport, equipment, &c., and capable of rapid mobilization and concentration. But though our home army is fairly strong in numbers, the mass of it is not nearly efficient enough in training and discipline to meet a Continental foe; it is incomplete in field artillery, cavalry, equipment, transport, &c.; and rumour says that no mobilization scheme exists, as the one drawn up some fourteen years ago was impracticable. We have only a full complement of field artillery for three out of our eight home Army Corps, while we have not sufficient organized transport for two Army Corps. Nothing has occurred since 1883 to alter what Lord Wolseley then said, that we could not in twenty-four hours scrape together more than 30,000 men and bring them down equipped to resist a sudden landing, and that the most we could put into the field, after some months, would be only 70,000 men. Further, field armies require secure bases, magazines, and lines of communication. At present London is the only base for our Army, and is in the heart of the probable theatre of operations, and its unsuitability for the purpose was recognized twenty-seven years ago, when the War Minister of the day wrote to the Defence Committee and said "it had been decided" to form a second arsenal distinct from Woolwich; yet this has never been carried out, although the Defence Committee proposed an arsenal at Runcorn, near Birkenhead, and a central dépôt at Cannock Chase. The admirable reasons for these selections still exist, while the creation of magazines all over the country so ably advocated by Sir Edward Hamley are urgently required, as also the decentralization of Government and private factories for field-guns, small arms, powder, and ammunition to enable a rapid, offensive war to be carried on by our home armies. The main reason why the French held out so long in 1870-71 was that from the decentralization of their supply establishments, they were enabled to arm and equip fresh levies, even after Paris was surrounded.¹ If everything had been concentrated in Paris as they now are in London (except a small rifle manufactory in Birmingham), this prolonged resistance could not have been carried out. Another point which strikes one in reading works on the defence of England is, that all nations speak of our Army standing on the defensive. From the small extent of our country and from the immense number of people that would be thrown out of work by the stoppage of our manufacturing trades, war in England could not last long, and even a superficial glance at the past invasions or attempted invasions of the United Kingdom will show that sharp, quick, offensive operations in our country have been the successful ones, while those that stood on the defensive have been nearly always beaten; consequently, our mobilization and concentration should be such as to allow of this being done, but it is doubtful whether the scheme of 1872 would have rendered such an offensive war possible. But I must leave

¹ Under present conditions, if London were cut off, this could not be done, as all our supply establishments are concentrated around London. The mere cutting of the railways leading from London, therefore, would under present conditions paralyze the defences of the country; thus showing the urgent necessity for decentralizing our supply establishments.—C. B. M.

this point, as it is not one under consideration. What I wish to point out is, that if money can be got there are many ways, as things now are, in which it can be better spent, including the strengthening of our naval arsenals and sea forces, than in fortifying London. London itself does not include anything like the wealth of Great Britain, which wealth really lies in the north and west of England, in our great manufacturing districts; while the trade of Liverpool alone nearly equals that of London; and any plan of mobilization and concentration should take this into consideration. All the large banking and commercial houses of London have their branch establishments spread over the country. In these days of innumerable railways, steamship and telegraph lines, commerce is getting more and more decentralized, and the landing of a strong hostile force in any part of England would so paralyze the whole trade of the country that the cutting off and even capture of London would not add much to the blow an invasion would give. But under existing conditions, which can easily be remedied, London is the vital point in our national defence. Within its limits are included our only Government arsenal, and our only large and field-gun, small arms, ammunition, powder, and equipment factories; and if London were only surrounded partly by more or less stationary infantry and partly by roving bodies of cavalry and light infantry, cutting the railways to the interior, we should be in a very bad way. London, as a rule, barely contains a week's supply of the necessities of life, and consequently such an investment, even if London were defended, would soon cause its fall, on account of the non-arrival of the immense daily fuel and food supplies required for its existence, and perhaps by the capture of the principal heads of its water supplies near Teddington Lock on the Thames. The supplies for London have, from all time, come in mainly from the centre of England, and on this account William I was enabled to reduce London by famine merely by taking up a position at Berkhamstead to the north-west of London, and Napoleon I is reputed to have intended doing identically the same thing if he had been able to put foot on our shores; consequently, without field armies to relieve London, no amount of fortifications would save it. In making this statement, the fates of Metz and Paris are examples.¹ If I may draw a conclusion, rather than fortify London under present circumstances I would remove the elements which make it of any primary vital strategic value to us, and organize public and private arsenals, factories for war material, depôts and magazines at the strategic points of the country. Chatham, Gravesend, and Tilbury should be made a vast bridge-head or rather tunnel-head to ensure the free passage of the Thames against the flank of an invader from the east or south, and our big gun factory at Woolwich should be given to the Navy and removed to some fortified post like Chatham or Portsmouth, at which our ships of war can receive their armament direct. But of all these things, a mobile and numerous field army is the essential point for the defence on land, capable of rapid mobilization and concentration, and complete with artillery, cavalry, transport equipment, &c., with full and well-placed fortified magazines and depôts of war material to rely on, and to obtain such an army instead of our heterogeneous one, composed of units of varying and often doubtful value. I hope that I may live to see the day, Sir, when we may have a militia conscription in the country before it is forced on us by a national disaster. Fortifications without sufficient troops to fight, both inside and outside of them, are like a dead body wanting the living or active spirit, and for moral, economical, social, and military reasons, an army raised by a conscription, universal as regards its application to class, is to me the best way of ensuring the requisite active spirit of offence required for the defence of our island home. It is not the knowledge of our fortifications that would deter a possible invader, but a knowledge that he could not hope to successfully compete with our

¹ Because Paris was provisioned rapidly and made a successful resistance in 1870, it by no means follows that London can do the same thing. The line of defence round Paris was 45 miles only, and included an area of a little over 100 square miles, with a population of rather over 2,000,000 souls. The proposed line of defence for London is 100 miles in length, and includes an area of 700 square miles, with a population of over 6,000,000 souls.—C. B. M.

field armies. This feeling, however, does not exist abroad at present, and no amount of fortification will create it, and until we can make Continental nations respect our field armies, we shall be in danger of invasion.

Lieut.-General Sir GERALD GRAHAM, *K.C.* : I think we are greatly indebted to Major Elsdale for a very valuable paper, and I only wish that the facts and arguments he has so clearly laid before us could be impressed with all their force upon the mind and understanding of the nation. I think the supineness and indifference with which this most important subject is treated by the country is a matter of regret. Taking the facts as they stand, if we assume that an invasion is possible, I consider, notwithstanding what Captain Mayne has just said, that the defence of the heart of the Empire is absolutely necessary. I think the examples adduced by Captain Mayne do not show the lesser importance of fortifying or protecting the capital. He would recommend as far as I understand a complete change in our military organization. I quite agree with him that we should have a vastly superior army if we had a system of conscription, but as you all know we have not got a system of conscription, and I think it would take an invasion to stir up the country to submit to it. Therefore we have to consider what we must do with the organization which exists and the means we have available. I congratulate Major Elsdale on the spirit in which he has treated this subject. It is said that every one should stick to his own trade. A shoemaker says there is nothing like leather, and an engineer says there is nothing like fortifications, but Major Elsdale has made the question of fortifications subject to other more important considerations. He has told us what we must admit, that the defence of the metropolis must be entrusted to the Volunteers, and with that in view, it is the duty of our Government to repose confidence in the Volunteers and to treat them properly. We must give the Artillery Volunteers the best guns. Nothing can be more absurd than employing Volunteer artillery to practise with obsolete guns. We must train our Volunteer infantry, we must encourage them to train for the defence of London. We should take as their model the organization that we have on board ship in case of fire, for we all know how every one is practised to run to his position on the first alarm. A ship is a thoroughly practical model; there is no possibility of considering what should be done after the fire arises, something must be planned out and arranged beforehand, every man must go to his post immediately and know what he has to do; he must take up the duty whatever it is, and that is what we want for the defence of London. Its very size and its enormous population make it more difficult to defend, as its enormous wealth makes it a greater prize—the greatest prize that an invader could possibly hope for. Captain Mayne has said that there are other points more important than the defence of London, that the country might fall even if London were held, but there is no single point in the whole country which could be carried by a *coup de main*, which would entail such a loss to the country, as London. We know that in the opinion of all competent authorities the fall of London would paralyze all our commerce, paralyze all the action of the Empire, and that such a thing must not be. We have heard from the lecturer that we must endeavour to protect London in the first place from a *coup de main*. It is an absolute necessity to protect London from a *coup de main* and the rest will follow; let us do that at least. Even supposing it be out of the question that there could be an invasion, it would be of enormous importance to us to know that the capital is protected; it would give the greatest confidence; it would be an incalculable advantage in a merely financial point of view. I believe if it could be really properly represented and brought to the minds of the people of the metropolis, they would subscribe the money now and it would be a good investment. I must say, considering the matter of the defence of this metropolis, and the enormous pressure of work that would arise on a sudden emergency, I pity the General Officer who would have to undertake it, unless every possible preparation that forethought and skill could devise had been made beforehand. The question of decentralization has been very ably dealt with—I believe that to be one of the most important steps to take in a defence. Major Elsdale has stated the extent of the provision of magazines, but he has said nothing about forts to protect them. I presume that we should have some provision for forts.

Major ELSDALE : I shall discuss the question of forts in my next paper: the

magazines and the ammunition on the ground are as far as I have got in this paper.

Lieut.-General Sir GERALD GRAHAM: I should have thought that they might as well enter into the second line of defence. The arrangements made by the caponiers appear to me to be admirable; the system of reserved flank defence is most valuable and important.

Lieut.-Colonel TOVEY, R.E.: I should like to say a few words as to the details of Major Elsdale's scheme. I quite agree with what he has said as to the importance of defending London. Judging from what one hears from naval Officers of the great deficiency in our naval strength, invasion can hardly be looked upon as altogether impossible in the case of a great war. I wish at the present moment, however, to speak only of the plan for the defence of London which Major Elsdale has brought forward in his lecture. He seems rather to shun recommending regular fortifications, lest it be thought that he must necessarily do so as being an engineer. Well, I am also an engineer, and of course one is always liable to have it said that one thinks there is nothing like fortification, as the shoemaker thought that there was nothing like leather; but I think this is a case in which that consideration may be neglected; for it appears evident that if the great capital of this country is to be defended, fortification is the best means for supplying that defence. The defence of Paris was a very great question in France from about the year 1820 to 1840, when the fortifications were actually built. It was discussed during these twenty years by French Officers of all arms of the Service. The discussion was not confined to the engineers, Officers of all branches of the Service were consulted, some of them Marshals who had seen service in the Napoleonic wars. Many different plans were suggested, but I think I am correct in saying that all agreed in recommending some system of permanent fortifications. Perhaps I may have misunderstood Major Elsdale, but his scheme, as pictured in my mind while hearing him, was a wide road along a circle of 100 miles in length and 30 miles in diameter round London, with open magazines every 5 miles, with no forts or fortifications, but with some form of caponier at intervals along the front. He has mentioned that he would entrust its defence to the Volunteers, and I perfectly agree with him as to the necessity for that. He calculated that he would have something like 200,000 or 300,000 men; but how this force was to defend a long continuous line 100 miles long he did not say. It appears to me that if you do not have forts of some sort you are simply defending an enormous position. I rose merely to draw attention to this. I think that if the impression were to go out to the public that in the opinion of a large and important meeting like this London can be rendered safe by constructing a road 100 miles long, with magazines and caponiers at intervals, it would be a very great pity.

Major-General BAILLIE, late Bengal S.C.: I wish to say a few words. Some ten years ago I had the honour of reading a paper on the same question in this theatre, but for some reasons it was not published. I considered the defence of London a secondary object, the object of my paper being to point out that fortifications might be economically constructed, that the only way in which fortifications could be constructed round London was to make them *pay* in some way or other. My first point was to suggest, as our gallant lecturer has already laid down, a double line of road, but in my paper what I proposed to make was a double line of railway; earthworks to be thrown up out of the ditch in front, and that ditch would be available in many parts as a canal. The point was how that was to be made with the least expense. I think that can be very easily done by letting the railways themselves contribute to the line by constructing a line at right angles to their own line as they enter London at a certain fixed distance outside. All our railways require enormous tracts of ground for their empty carriages. The coal supply of London every day requires 10 miles of empty carriages to be stowed away somewhere and go out next morning. I do not say that we should compel the railways to make the line as a military work, though we have compelled them to do a great many things such as our great Saltash and Menai bridges and so on that were scarcely necessary; but in this case I think that every railway that came into London should construct say a mile or a mile and a half on each side perpendicular to it; the cost of connecting these lines together in a great circle about London would fall in a very small sum

upon the community. The forts themselves might also be utilized. We have recently been rearranging our gaols; many of these might have been placed with great advantage at a distance outside, and if you take the plans of our forts of Portsmouth, many of the large forts on the Gosport side, I do not think they could be better used than as gaols, or for many purposes, such as sites for hospitals for infectious diseases, and of some objectionable manufactories which it would be very desirable to get out of London. These forts might be built by the Government and their interior arranged for these purposes, and I think by the time they were really called into use as forts they would have repaid a very respectable rental.

Captain C. B. MAYNE, R.E.: May I be allowed to correct a false impression, Sir as to what I said? It seems to have been thought that I advocated conscription as a remedy for our defenceless state; I only said I should like to see it. The remedy I proposed was that our present field army should be thoroughly equipped with artillery and cavalry, and every means of moving and living, before any secondary matters were attended to.

Major ELSDALE: The only point which I think has been raised to which I ought to reply on this occasion is in Sir Gerald Graham's remarks. In reply to those I may say that so far from saying that London should not be fortified I shall in my next paper discuss how it shall be fortified, where it shall be fortified, and how we should best spend the millions I think we ought to spend upon fortifying it. The point of this paper has simply been this, not to say that we do not require fortifications, but that we do require a strong reserve position for our field army to occupy or fall back upon—a stronger reserve position than we have got at present. The way to strengthen that position is to provide guns and ammunition, and to get that special supply of guns and ammunition which I contend are necessary actually on to the spot. The whole question is,—will a General who is charged with the duty of defending our capital against such an attack be in an altogether stronger position than he is at present to meet the attack if you give him eighty powerful guns with 100 rounds per gun actually on the position which he has got to occupy, and which as Colonel Tovey most justly said is 100 miles long? But in order to enable him to make sure of getting those guns, or a great part of them, and that ammunition, and the machine-guns and their ammunition on to the right spot, I propose to spend 400,000*l.* in giving him special facilities for doing so in roads, railways, and telegraphic communication, and I shall show in my next paper when I come to consider the question of the turning movement of the enemy that it is contrary to all reason and to every sound military judgment that we could possibly be turned or out-flanked. The General in command of the troops who has to occupy that portion of that position which may be in the zone threatened by the enemy will have an overwhelming advantage in flank communications in moving and shifting his defence as compared with an invader. How, when, and where we shall provide such further means as may be necessary to supplement those I shall discuss in my next lecture.

Friday, May 14, 1886.

MAJOR-GENERAL SIR ANDREW CLARKE, G.C.M.G., C.B.,
C.I.E., R.E., in the Chair.

THE DEFENCE OF LONDON AND OF ENGLAND.

By Major H. ELSDALE, R.E.

PART II.—*The successive Stages of the Defence.*

IN the former portion of this paper I argued that the establishing of such an amount of protection for our capital as will secure it against a sudden attack by such forces as an enemy can hope to carry across the Channel at one time is a matter of the most pressing national importance.

I trespassed upon your patience so far as to go into this portion of the subject at considerable length, not only because it seems to me to be of the greatest importance in itself, but because such protection to our capital if judiciously carried out will afford an excellent basis and groundwork for such other more complete defensive measures as may hereafter be decided on.

But the question of the proper defence of London is inseparably bound up with, and cannot be properly treated apart from, the more general question of the defence of England against invasion. For any kind or degree of protection which we may give to our shores, or any obstacles we may put in the way of an advancing enemy between the coast and the capital, are clearly so much protection given to London.

It is now therefore desirable to enlarge our horizon considerably, and I propose here to review in much less detail the general course of a probable invasion of England having for its goal and ultimate object the capture of London, together with the preparations by land necessary for meeting such an invasion.

An analysis of the whole subject in the order in which I propose to deal with it is given for convenience in Table I below.

TABLE I,

Showing the Successive Stages of the Land Defence against Invasion.

| Order of work to be done for the defence of London. | Approximate cost of items included in the defence of London itself. |
|---|---|
| <p><i>Stages 1 to 9. Defensive Preparations in Peace.</i></p> <p>Stage 1. Decide upon a continuous circle of defence round London, to be held at any point by our existing forces, supplemented by a strong movable reinforcement of powerful guns of position and machine-guns, supplied by good permanent magazines at moderate intervals, with assured communications everywhere. <i>We secure London thereby against a coup de main,</i> and force an invader to undertake larger and more extended operations for its capture, involving the continued command of the sea, and the occupation of a harbour on the coast as a base of operations.</p> <p>„ 2. Complete the fortifications of Chatham. Secure the passage of the Thames from Gravesend to Tilbury by permanent works on each side. Secure the coast-line northwards from the Medway as far as Harwich by land batteries, and by a local force of gun- and torpedo-boats.</p> <p>„ 3. Secure the great naval ports and dockyards.</p> <p>„ 4. Secure our most important commercial harbours being those most convenient to an enemy as bases of operation against London, or most important to protect our commercial marine and the food supply of our population.</p> <p>„ 5. Guard the coast-line in certain localities favourable for disembarkation, especially in those best calculated to prevent the enemy from landing, marching on a neighbouring harbour, turning its defences, and securing it as a base.</p> <p>„ 6. Provide by the construction of one or two entrenched camps in Ireland, and by the fortifications of the Isle of Anglesea and Holyhead, for the recall of most of the garrison of Ireland, while securing its possession and reoccupation at any time.</p> | |
| | <p>£ 900,000</p> |

| Order of work to be done for the defence of London. | | Approximate cost of items included in the defence of London itself. |
|---|---|---|
| | | £ |
| Brought forward.... | | 900,000 |
| Stage 7. | Construct a number of permanent works to strengthen the first line of defence round London at important points. | } 1,040,000 |
| „ 8. | Construct a set of reserved fighting positions nearer the capital, as an inner line for the defenders to rally upon and check the enemy, in case the first line is forced. | |
| „ 9. | Construct three permanent entrenched camps near London to strengthen the defence, and to provide rallying points and bases of operation for our troops against a victorious enemy. | } 1,050,000 |
| <i>Stages 10 and 11. War Preparations.</i> | | |
| „ 10. | Construct a number of small hasty provisional works to strengthen the line of defence on the threatened front. | |
| „ 11. | Construct a line of provisional redoubts on the threatened front. | |
| <i>Stages 12 to 18. The Seven Stages of the Struggle from and after an Enemy's Landing.</i> | | |
| Stage 12. | Oppose the landing, drive any of the enemy who may land into the sea, if possible, before they can establish themselves on shore. | |
| „ 13. | If the enemy make good his footing on shore, check him, while securing the nearest harbours, or rendering them useless to him as bases when captured. | |
| „ 14. | Recall the garrison of Ireland to assist in the defence. | |
| „ 15. | If the enemy secure a base, shut him up in it. | |
| „ 16. | If the enemy secure his power of debouching from the base, obstruct his march and gain time. | |
| „ 17. | Fight on the prepared line of defence. | |
| „ 18. | If the line of defence be forced, rally on the reserved fighting positions; hold on to the Thames and entrenched camps, organize street fighting on an immense scale, and defend London house by house. | |

| Order of work to be done for the defence of London. | Approximate cost of items included in the defence of London itself. |
|---|---|
| <p style="text-align: right;">Brought forward....</p> <p>Stage 19. If the enemy be everywhere victorious in the field, the ultimate defence of the capital, and the possibility of continuing the struggle if it be captured, will best be secured by the construction of entrenched camps at commanding points round it (see Stage 9 above), and by a central arsenal at a distance from it.</p> | <p style="text-align: right;">£ 3,990,000</p> |
| <p style="text-align: right;">Total £ Say £</p> | <p style="text-align: right;">3,990,000 4,000,000</p> |

You will observe that the security of London against a *coup de main* as above constitutes Stage 1 of this table. It is followed by eight further measures or successive stages of defensive peace preparations. These are all, as I shall submit to your judgment, legitimate and reasonable. A strong and patriotic Government, with a clear view of the realities of our position at present and the enormous interests at stake, might most properly carry them out. But they are not all equally or all at once necessary.

The question of their comparative importance, and of what amount of money ought in reason to be spent upon them at present or at any future time, cannot be satisfactorily or properly dealt with without a still further widening of our horizon, so as to include at one view the requirements of our Navy and other leading defensive necessities of our Imperial position generally. For it is clear that as our Navy is stronger it has a better chance of defending our shores from invasion and so securing our capital, and *vice versâ*. And it is clear that we must protect the food supply of our population, otherwise we shall be rapidly starved into submission, and all our defences rendered useless. So if we are to form any sound general conclusion on the subject, and appraise any item in our programme of land defences in Table I at its just relative value and importance, it seems absolutely necessary to include under our view these other Imperial requirements. I have therefore thought it necessary to submit here a further table, Table II. In this I have endeavoured to arrange such a general schedule of some of our leading defensive requirements, whether naval or military, and to show in it the proper place and approximate relative importance of these various successive items advocated in Table I.

Table II,

Showing the Items (as estimated) of Defensive Peace Preparation against Invasion given in Table I (*here printed in italics*), arranged in their Proper Place and supposed Order of Relative Importance in a more General Schedule of our Leading Naval and Military Requirements.

Order of
importance.

Primary Measures to Resist Invasion.

- | | | |
|----|---|--|
| I. | { | 1. Ironclad fleet to command the Channel. 2. Movable force of gun- and torpedo-boats to assail enemy's vessels and oppose a landing. 3. Protection of Royal dockyards or naval ports. (a.) By forts and submarine mining. (b.) By local gun- and torpedo-boats, and coast defence vessels. 4. <i>Defence of London against a coup de main.</i> 5. Defence of the mouths of the Thames and Medway, and coast as far north as Harwich. |
|----|---|--|

Primary Measures to Secure our Food Supply and Commerce.

- | | | |
|-----|---|--|
| II. | { | 6. Fleet of fast cruizers to sweep the seas. 7. Protection of our leading commercial harbours. 8. Protection of our leading foreign harbours and coaling stations. |
|-----|---|--|

Primary Measures necessary to Secure our Position and Interests at Home and Abroad.

- | | | |
|------|---|--|
| III. | { | 9. Mediterranean squadron. 10. Defence of coast-line where suited for a landing. 11. Entrenched camps in Ireland; fortification of the Isle of Anglesea and Holyhead. 12. <i>Forts to strengthen the line of defence round London.</i> 13. <i>Reserved fighting positions to strengthen the defence of London.</i> |
|------|---|--|

Secondary Measures necessary to Secure our Position and Interests at Home and Abroad.

- | | | |
|-----|---|---|
| IV. | { | 14. Royal Navy where not included above. 15. A fortified central arsenal. 16. <i>Entrenched camps round the capital to strengthen the defence against invasion.</i> 17. Protection of our remaining commercial harbours. 18. Protection of our remaining foreign harbours and coaling stations. |
|-----|---|---|

I hope that my object in submitting this second table will not

be misunderstood. I do not for one moment undertake to decide upon the exact comparative value and importance of these various and widely-removed requirements. I do not pretend to say, for instance, how much out of any given number of millions to be spent upon our Army and Navy should be allotted to the defence of our capital in any of its stages, or to some other of these our various requirements at home or abroad. My object in submitting this table is quite different. It is threefold.

I wish first to make it clear to you in a practical way that the views here put forward are moderate. I am not blindly advocating an enormous or extravagant outlay on the defence of London to the exclusion or neglect of our other requirements. Thus you will observe that the expenditure of a considerable sum is here advocated for the construction of powerful entrenched camps to strengthen a line of works for the defence of London, and to give the basis necessary for further resistance in case this line were forced by an enemy. But although such an expenditure is considered legitimate and proper, pray note that it is placed very low down in the list, after a whole host of other naval and military requirements which it is thought should be first attended to. Very probably some Officers will think I have underrated rather than overrated the importance of these entrenched camps.

Secondly, I wish to submit a definite basis for discussion in order that the opinion of the members of this Institution may be elicited, and if possible some substantial agreement arrived at upon these great questions, with which the safety of our capital and our country are so intimately bound up. Do we consider that London should be protected by special works or do we not? Or are we prepared to throw upon our Navy, or upon any coast defences, or upon both combined, the tremendous responsibility of its protection? If we should agree that it ought to have independent protection, then shall we rest satisfied with a strong defensible position on every side of it, or ought we at once or at any later stage of our general defensive preparations to fortify it regularly? Or how far shall we trust to provisional works to be thrown up in a hurry whenever the occasion may arise? If something like a general consensus of professional opinion on such fundamental points as these could be arrived at, it would I apprehend be a most excellent thing. The hands of responsible heads of departments should be greatly strengthened thereby in dealing with these questions.

Thirdly, I desire by these tables to make clear to you the position which I occupy, and am prepared here to support, in respect of two or three opposite or supposed opposite schools of opinion on the question of the defence of London. One set of Officers, whose opinion is entitled to great weight, say, and have long said, that in view of the supreme importance of our capital it ought by all means to be regularly and strongly fortified against any and every attack. Others at the opposite side of the controversial arena, to whom the great Austrian strategist, Baron von Scholl, has lent the weight of his great authority, take a different view. They say that the evil conse-

quences of allowing an invader to march through our small, densely-populated, and highly centralized country, especially in view of his possible occupation of our great manufacturing centres, would be so enormous, and that the defensive line afforded by the sea coast is so advantageous generally, that we cannot afford to limit our defences anywhere short of our coast-line. The proper defence of London in this view is on the high seas and at the coast, and not in any works at or near it.

A third set of Officers occupy to a certain extent an intermediate position between these two extremes. They would give up the idea of defending London by special works on account of its vast size, and the great supposed expense involved. At the same time, in view of the great length of our coast-line, and the many points at which an invader might land, they are not prepared to scatter our small army and dispose it at or near these numerous points to be in immediate readiness for opposing a landing. They would sacrifice to a certain extent this object of offering the strongest possible opposition to an enemy at or immediately upon his landing. While presenting then any available local opposition, they would reserve our main defence, and would gather up our forces to oppose him in the best available position between the coast and the capital, according to circumstances and the direction of his march. It is this last course to which we are more or less committed by the facts of the situation at present, and this is likely to remain the only course open to us in the absence of any special preparations and arrangements matured in peace for enabling us to adopt one of those previous alternative courses in war.

The position which it is here sought to maintain on this whole question will be made clear to you by these tables as we proceed.

Let us now glance through Table I and say a few words as required upon the various items or successive stages of the defence.

Stage 2.—*Complete the fortifications of Chatham, secure the passage of the Thames from Gravesend to Tilbury by permanent works on each side. Secure the coast-line northwards from the Medway as far as Harwich by land batteries and by a local force of gun- and torpedo-boats.*—The security of the mouths of the Thames and Medway is evidently an object of the first importance. Our coast-line northwards towards Harwich is so close to the capital, and so open to attack, especially at the mouths of the Blackwater and Crouch, by an enemy well supplied with boats or a flotilla of light-draught vessels, that it ought most clearly to be protected. The security of the passage of the Thames is, moreover, an object of the first strategic importance. For by a well-fortified *tête-de-pont* here, we put the garrison of Chatham and all the troops in the south-east of England in a most favourable position for operating on the flank of an enemy advancing anywhere from the side of Harwich or the north-east, and *vice versâ*, we enable the troops at Harwich or the north-east to be sent southwards to assist the defenders of Chatham and the south-east.

These objects hang all together and cannot well be separated. They are so intimately bound up with the security of London that they should apparently be considered as of primary importance, and

take precedence of everything else. Whatever else may or may not be done for the permanent defence of our capital, or for any of our numerous other requirements at home or abroad, I submit to your judgment that these two items (Items 1 and 2, Table I) should be forthwith attended to. Accordingly you will observe that I have placed Stages 1 and 2 together in the first rank of relative importance in Table II as urgently requiring attention at this moment.

3. *Secure the great Naval Ports and Dockyards.*—The moment we have, as above, arranged to give our capital some reasonable amount of immediate protection at a moderate expenditure, that moment we ought, as it seems to me, to give up all idea of any further present expenditure upon its more regular and complete defence.

Baron von Scholl's argument now comes in regarding the importance of our coast protection. So we ought apparently to turn our eyes seawards, and deal next with the security of our great naval ports and dockyards as the nurseries and bases of operation of that great right arm of our strength, the Royal Navy.

4. *Secure sixteen commercial harbours selected from those most convenient to an enemy as bases of attack against London, or most important to secure our commercial marine and the food supply of our population.*—Once let us have secured London against a sudden *coup de main*, and an enemy cannot well do us any harm in an invasion without first making himself master of, and establishing himself strongly in, a good harbour as a base of operations on our coast. For otherwise his communications with the invading army and the maintenance of its necessary supplies would be most precarious and uncertain. They would be liable to be severed, and his forces left isolated, by stress of weather alone apart from hostile movements of ours. No enemy could apparently afford to undertake an operation of this magnitude on such a precarious footing, although it may be well worth his while to do so at present, while our capital lies invitingly open. So the capture and secure maintenance of a good base on our coasts would be almost inevitable. Next, therefore, after the great naval ports with their dockyards, which, if captured, would afford invaluable bases to an enemy, we ought to secure all those points on our coast which afford him convenient and accessible marine bases, especially those most conveniently situated for his march on London. Thereby we shall place him in the position of being obliged either to undertake at the outset of his expedition the difficult and arduous operation of forcing our prepared defences, and capturing such a base in the teeth of our strenuous opposition, or of submitting to the great disadvantage of having to put up with an inconvenient and incommodious harbour at a great distance from his objective, whereby all his operations would be crippled, and an invaluable gain in time would be secured to the defence.

Intimately bound up with this question, and of no less importance, is the further one of guarding our great commercial harbours, upon which depend the security of our vast commercial marine, and the food supply of our population. It seems clear that these two questions cannot be separated, but should be dealt

with as part and parcel of one great problem, the security of our coasts.

Sir Charles Nugent has so recently favoured us in his important papers read in this Institution, with a list of these harbours, and with valuable information concerning them and the coast-line generally, that it is unnecessary here to do more than refer to his list.¹ These harbours are twenty-six in number, excluding Chatham and the great naval ports. I should propose to deal first with about sixteen of the most important. The land defences would consist of forts, open batteries, or submarine mines according to circumstances. These would co-operate with such local gun- and torpedo-boats or harbour defence vessels as may be available.

5. *Guard the coast-line in certain localities favourable for a disembarkation, especially in those best calculated to prevent the enemy from landing, marching on a neighbouring harbour, turning its defences and securing it as a base.*—Viewing the limited time at my command I cannot here afford to say much upon this item. It is evidently a most necessary part of our coast defences, calculated to supplement and complete the defences of our harbours. There is much now requiring to be done in giving security to these exposed portions of our coast-line by the opening up or improving of coast-roads where required, the establishing of telephonic and telegraphic communication along the accessible beaches, with good look-out and signal stations at intervals, the organizing of local corps of volunteers for defence, and the construction of batteries to be manned by them, as well as by well-considered arrangements for despatching mounted corps of regular cavalry, yeomanry, and horse artillery from central positions inland at the shortest notice to any given point. Those forces should co-operate with small gunboats of light draught stationed locally in central situations in squadrons of not less than six. These would carry one or two long-ranging guns each wherewith to interrupt the landing from a distance. They would be manned by sea fencibles or marine volunteers from the maritime coast population.

This whole question of the defence of our coast, including the harbours, is very important. There is ample room for a most valuable discussion of it; and it is a matter for great satisfaction that we are shortly to be favoured with a paper from an able naval Officer upon it.²

6. *Provide by the construction of one or two entrenched camps in Ireland, and by the fortification of the Isle of Anglesea and Holyhead, for the recall of most of the garrisons of Ireland while securing its possession and reoccupation at any time.*—In case of a supreme struggle for our national existence such as is here in question, it will be generally admitted that we cannot afford to leave a large garrison of regular troops in Ireland as at present. Every available man will be urgently required for the main contest, and all such minor issues as the security

¹ "Imperial Defence: Home Defences." By Col. Sir Charles H. Nugent, K.C.B., see Journal, vol. xxviii, p. 427, *et seq.*

² Rear-Admiral Arthur, C.B., "On the Defence of the Coasts and Harbours of England, Ireland, and Scotland, in case of War." See this No. of the Journal.

of Ireland must, if necessary, be sacrificed for a time. At the same time it would be a most serious step, and a most humiliating confession of weakness, to withdraw all our troops unconditionally, and leave Ireland to its fate without making any provision for its security or reoccupation. We ought, therefore, apparently to consider whether there is any intermediate course which while setting free the troops, or most of them, during the emergency in England, would yet provide such a necessary basis for the security and early reoccupation of Ireland as would enable us to tide over the crisis satisfactorily without incurring the reproach of abandoning it. I submit that such a course is to be found in the construction of a small but strong entrenched camp on the south-east side of Dublin, where there is very suitable commanding ground. This would secure the very important harbour at Kingstown on the east side, and command the city on the west.

The security of Holyhead has already been included among our commercial harbours generally. It is clear that it is specially important when viewed as the necessary communication with Ireland, and that the Isle of Anglesea also, of which it forms part, should be secured.

Supposing these objects—the construction of an entrenched camp near Dublin, with its works on the north-east side commanding the Kingstown Harbour, and the fortification of the Isle of Anglesea, including the bridges of Bangor and the harbour at Holyhead—to be properly attended to in peace, it is clear, I think, that we should occupy a most advantageous position. We could recall the garrisons of all the outlying stations in Ireland to England, leaving only a small nucleus of the regular troops for the defence of the entrenched camp. These could be supported by a moderate number of militia or volunteers, sent over from England if necessary for the purpose. Or the defence could be largely left to detachments from the Irish Constabulary, an excellent and well-disciplined body of men, who could easily be taught to work the heavy guns and all necessary duties at very short notice. Large numbers of special constables would at the same time be sworn in, from the more law-abiding and respectable classes of the population, to assist the police in the maintenance of order in every district throughout the country, as required.

If then from Fenian or Home Rule agitation, or from the want of any sufficient number of reliable persons as special constables in any district, order could not be maintained therein in the absence of the troops, anarchy must be allowed to prevail till the crisis is over.

An enemy would hardly think it worth while to invade Ireland. If he were to do so it would be the best possible thing for us, as all his troops so employed would be so many out of the reckoning for the most serious work of invading England. And with our fortified camp and secure harbour near Dublin, we should be in an excellent strategical position, the best position which the circumstances admit, for opposing him.

It is then a further question whether a similar plan should not be adopted at Queenstown for the security of that splendid harbour. A

moderate expenditure on works in aid of our present defences there ought probably to enable us to secure this harbour both by land and sea. We should thus have two fortified and strongly held points, one on the east and one on the south coast of Ireland. These would dominate the whole country, and secure its possession and reoccupation. They would, moreover, place us in an excellent position for meeting the attack of an enemy from any quarter, while leaving a minimum number of troops outside England.

Political discussions are out of place within these walls, and I do not here discuss our present or future political relations with Ireland. Nevertheless it will be clear to you that if these suggestions were adopted they would go far to secure our military position and interests there in any and every eventuality. For we should then hold two doors leading into Ireland, by aid of which we could enter upon or withdraw from its military occupation at any time, at our own discretion and convenience. *Those doors we should lock and hold the keys in our own hands with a firm grasp against all the world, and against every enemy, whether from within or from without.*

7. *Construct a number of permanent works to strengthen the first line of defence round London at important points.*—It has been said in my former paper that there is nothing in my proposals to interfere with the regular permanent fortification of our capital, but that they should rather be regarded as paving the way for and leading up to it. It will appear by the relative order of importance which is assigned to such permanent fortification in Table II, that once our capital has been made reasonably secure against a *coup de main*, I should argue that we ought to defer any further expenditure upon its more regular and permanent fortification until a number of our other Imperial requirements, which will then be more pressing, have been attended to. But without such permanent fortification the defence of our capital will no doubt remain partial, incomplete, and of a more or less makeshift character; and I hope that the majority of Officers who have considered the subject will agree that the fortifications of our capital are a matter of great importance, calling for and fully justifying a large, deliberate, and well-considered expenditure.

Starting from our proposed first line of defence, considered at length in my former paper, as a basis, and assuming that work to have been carried out as an immediate and urgent matter, I would now ask you to consider the various steps of our proposed permanent fortifications. These works are divided into three successive and distinct stages, following all through the same guiding principle of doing the work piecemeal by successive additions on one single uniform and consistent design.

I propose in the first instance to confine ourselves to strengthening our first line of defence locally by the construction of good, powerful, permanent works of moderate size, armed with heavy guns, at important points along the perimeter.

Such points, the configuration of the ground marks out for us most clearly and unmistakably as regards the southern half of the position. They are the gaps or gorges in the line of heights along which our

line of defence passes. Through these gorges run the railways and the more important roads leading on the capital. By occupying the heights, forming the shoulders of these gorges with strong, permanent works, we shall gain a great tactical advantage by effectually securing the weakest and most accessible points of our extended position. We shall effectually drive the enemy off the line of the main roads and railways. This will most seriously cripple and retard his movements. Or we shall bring him to a standstill till he has taken the forts. If he elect to leave the forts unattacked and untaken, and succeed in forcing our line by a direct attack on the heights elsewhere, the forts will still render most excellent service. The enemy will be placed at a most serious disadvantage, and all his operations will be obstructed and lengthened by his having to carry on his communications off the main line of railways and roads, as well as to leave strong works threatening his rear. These he must mask by large detachments of his troops, and they will form most favourable bases and starting points for counter-attacks on our side directed against his line of supply and retreat. On the north side we shall similarly bar the leading lines of approach on our capital by occupying favourable commanding positions. One or two strong works should also be devoted to protect the water supply of the metropolis.

I propose thus to fortify our line, in sixteen places in all, by one or more suitable works in each case. These will be of greater or lesser size and strength according to the ground and circumstances. Taking the average cost of the works in each locality at 65,000*l.*, the total cost will be about 1,040,000*l.*

These isolated works would of course be powerfully supported in action by strong batteries of our field artillery and guns of position, thrown up for the purpose as part of the general defence of the adjoining line.

8. *Construct a set of reserve fighting positions nearer to the capital as an inner line for the defenders to rally upon and check the enemy in case the first line of defences is forced.*—I shall assume that it would be very unsatisfactory to trust entirely to a single defensive line so far from London, and having such an extensive perimeter, even if this line were to be defended by a large number of permanent works throughout its length. Still more is this the case when, as above, we are only proposing to fortify regularly the more important and vulnerable points of this great circle of defence. At the same time, it does not seem desirable to advocate the construction of a complete second line of defence throughout, on account of the great value of the ground in the suburbs of London, and great consequent expense of its construction. Following leading authorities on this subject, I would here propose the construction of reserved fighting positions, or strong defensible lines, covering the approaches to the capital. It is unnecessary for the present purpose that we should discuss the precise construction and locality of these lines. They would be arranged in suitable sections and dominant positions as regards the ground, so as to form natural and direct rallying points for the defenders when driven from the outer line or advanced position.

They would be at a considerable distance from the latter and much nearer the capital, which they would cover for practical purposes, so that the enemy would be bound to attack them.

As they would be formidable lines armed with heavy guns, he would be obliged to feel his way carefully, and to bring up a powerful force of artillery well supplied with ammunition for the attack. He must thus abandon all idea of occupying the capital by a bold forward march following immediately upon his victory, and much time would be gained to the defence. This would be invaluable for the execution of the stringent measures which the urgency of the situation would now demand, namely, the removal of non-combatants from that portion of the vast city lying in front of the enemy, and the preparation of barricades and street fighting. I shall argue later on that the true reserved defence and ultimate strength of London in any such supreme emergency lies in obstinate and well organized street fighting on a colossal scale, and not in any works whether small or great. I would merely ask you to note here that I regard this second line of works or reserved fighting positions mainly as a certain and reliable means of gaining the time necessary for the proper organization and preparation of this street fighting. With this view, I should not propose to make them as elaborate and costly as many Officers would think necessary. But the ground would be very expensive, so I allow 1,000,000*l.* for their construction.

9. *Construct three permanent entrenched camps to strengthen the defence, and to provide rallying points and bases of operations for our troops against a victorious enemy.*—This is the final stage of the defensive works, and constitutes as it seems to me the limit of the expenditure which it would be reasonable and proper to ask for in connection with this all-important subject of the defence of our capital. In order to exhibit and enforce the great value of these entrenched camps, let us revert for a moment to first principles. Let us take the broadest and most general view of the whole situation and ask ourselves this question: What are the primary and ruling conditions of the defence of London; wherein lies essentially its strength and its weakness? I answer without the smallest hesitation that the strength of London lies in its vastness, in the fact that it is divided into two portions capable of independent defence by a strong obstacle, the Thames—in the colossal scale of the forces and operations required for investing it properly, so as to cut off its supplies and starve it into submission. The weakness of London also follows from its huge size. Thereby the perimeter of the works required for its defence is so great that they tend to be strong nowhere, but to be open to a determined and concentrated attack almost anywhere. Now how can we at the stage at which we have now arrived best deal with these conditions, so as to utilize and improve to the uttermost our strength, and at the same time to reinforce and remedy as far as possible our weakness? The answer lies, as I submit to your judgment, in the construction of a few powerful entrenched camps at commanding and important points outside London. These will form strongly-held points within half a day's march of the capital. They will be so far

off that the ground required can be purchased and cleared at a moderate price, which is very important for economy, and yet so near that the position of an enemy penetrating between them and the capital, with a view to invest it without first capturing them, will be very critical and dangerous. By gathering up the defence at intervals into salient, commanding, and well-defended camps, capable of securely holding large garrisons, of strength unknown to the enemy, they will place him in the position of being obliged either to attack them at a great cost in time and means, or by refusing the attack to incur a most serious military disadvantage, and a great risk of failure in his attack on the reserved fighting positions behind them. They will present invaluable centres or bases of operations for large bodies of raw or only partly-trained troops, who can there be securely armed, equipped, drilled into efficiency, and held in immediate readiness for action when required in the midst of the turmoil and confusion inevitable in such a great struggle. As they would be well supplied with magazines and stores of all kinds, they would further render most efficient and valuable aid in that decentralization of the supply of stores and munitions of war, which has here already been insisted upon as most necessary. Finally, they would in the event of a disaster, or a series of disasters, form strong rallying points, which would enable the struggle to be continued with a good prospect of ultimate success, under conditions such as in their absence would render further resistance almost or altogether hopeless. Three of these camps at an average cost of 350,000*l.* apiece are here allowed for. I should place one of them near Dorking, one in a commanding position on the north-east of London, probably near Epping, and the third in a similar position on the north-west side, probably near Watford. But the exact locality is a matter for detailed consideration and enquiry, and I am not careful about it.

War Preparations.

10. *Construct a line of small hasty provisional works to strengthen the line of defence on the threatened front.*

11. *Construct a line of provisional redoubts to secure the threatened front.*—Provisional works will come in most opportunely to defend and close the long intervals which the supposed execution of the works in Stage 6 of our peace preparations above may have left in our defensive line. We should then be in the position of having the most important and vulnerable points on that line everywhere guarded by good permanent works, and could devote our energies in a crisis to strengthening the intervals on the threatened quarter with provisional works.

STAGES 12 TO 18 (TABLE I).—THE SEVEN STAGES OF THE STRUGGLE FROM AND AFTER AN ENEMY'S LANDING.

Stage 12.—*Oppose the landing. Drive any of the enemy who may land into the sea, if possible, before they can establish themselves on shore.*—

It would be foreign to the purpose of this paper to discuss the best means of preventing an enemy's landing on our shore, which is a large subject requiring separate consideration. It is extremely important, for besides our numerous and unprotected or imperfectly protected harbours, I have the high authority of Sir C. Nugent for saying that there are 88 miles in all of beach accessible and practicable for a landing on that portion of our south coast alone included between Margate and Selsea Bill. The question of how far we can afford to scatter and disperse our regular troops, or any portion of them, in those localities near the coast best calculated to enable them to be quickly on the spot to oppose a landing, and how far we must not rather gather them up and concentrate them in more central localities inland, is an extremely important one. I will only here say that it seems pretty clear that unless the enemy make an attempt on one of our fortified harbours, such as Portsmouth, where there are regular garrisons to oppose him, any resistance by land we may be able to offer in the first instance must be mainly confined to the efforts of local corps of volunteers, sea fencibles, and a proportion of the local militia, assisted by small flying columns of regular or yeomanry cavalry and horse artillery, sent down when summoned by telegraph from central stations, a short distance inland in each district. The peace preparations required to strengthen such a defence we have already dealt with.

13. *If the enemy make good his footing on shore check him, while securing the nearest harbours or rendering them useless to him as bases when captured.*—So long as any of our important harbours suitable to serve as bases for an enemy in an invasion of England are left unprotected, or so insufficiently protected that their capture by a bold and determined attack may be reasonably calculated upon—so long will the enemy be tempted to make them the immediate object of his attempt in the first instance. But measures are now most happily in progress for securing our most valuable and vulnerable harbours. In proportion to the extent and completeness with which these may be carried out will be the increased probability that an enemy will then decline the direct attack or make it only a collateral part of his operations, and will trust mainly to turning and capturing these defences by a sudden landing on some accessible point of the coast anywhere in the neighbourhood of the harbour in question, and a forced march upon them. In such a case as this our exertions on the defence must be mainly directed to two points. Every effort should be made to check the enemy in his march, to delay all his operations, and give time for organizing and strengthening the defence. And at the same time the most decided measures must be taken to render the harbour useless if captured. If a number of colliers, merchant steamers, or any available vessels are placed in positions such that they can be scuttled and sunk at the shortest notice at the entrance of the harbour, the Officer in command will then know that if the day goes against him, or if he is not strong enough to make a good defence, the place when it falls into the enemy's hands will be of little value until the channel has been cleared after a great loss of time.

14. *Recall the garrison of Ireland to assist in the defence.*—When an enemy has succeeded in landing in force and establishing himself on the soil of England, it is high time to recall the bulk of the garrison of Ireland. I have already pointed out the means whereby this can apparently be best effected without abandoning or giving up the command of Ireland.

15. *If the enemy secure a base, shut him up in it.*—Let us suppose an enemy to make himself master of one of our harbours, whether by direct or indirect attack as above, and to land in only moderate force in the first instance. This may very probably be the case, especially if he make two or three landings, or pretended landings, simultaneously at different points on the coast, with a view to distract and mislead the defence. His intention is then to strengthen and establish himself in the occupied harbour, and to turn it into a protected base for his subsequent operations, when he will land the main bulk of his forces at the base thus secured. Our primary and most obvious course is then to assemble all the troops from all quarters immediately available, and by a determined attack drive him into the sea if possible. But he will be prepared for this, and will not lose a moment once he has captured the harbour in fortifying himself against such an attack. The question as to whether we have a better chance of thus overpowering him by a vigorous attack with superior forces, or of shutting him up in the place which he has occupied, will depend upon the ground, time, and circumstances. But in most cases, the latter will be our best chance. For no enemy is likely thus to land on our shores with less than one strong Army Corps complete, including a powerful force of artillery. It will take two or three days or more, according to the locality and circumstances of the moment, before we can bring up a force calculated to attack them with any good prospect of success. Meanwhile, if the local conditions are not very unfavourable, they will have established themselves very strongly in a defensive position. A failure in an attack on it would go far to demoralize our men and encourage the enemy at the outset of the campaign, and is by all means to be avoided. It will generally pay us much better to bring down every man and every gun available, to drive in the enemy's outposts and confine him within the narrowest possible limits inside his defensive line, and to fortify ourselves strongly on our side in the best available defensive position commanding his debouches from his base. Our position should have a good communication by road and rail for our own supplies, and a sufficient water supply. We ought then rapidly to improve it with all the resources of Great Britain in men and means, till it is transformed into a large and powerful entrenched camp, manned by a great army. This course throws upon the enemy all through the onus of attacking us in our own prepared and strong position, where our less trained or untrained troops will have no occasion to manœuvre in the open against his more practised battalions. We also gain this great advantage, that we confront the enemy firmly at the outset of his invasion, and bring all his operations to a standstill until he has attacked us at a great disadvantage on prepared ground of our own choosing.

With our enormous command of railways we ought to be able to bring down men, guns, materials, and appliances for the defence of our position faster than he can bring over men, guns, materials, and appliances from the Continent to attack it. And I would bring down every man and every gun to be found in all Great Britain, if necessary, to maintain our superiority. Then let the enemy strengthen himself in his base as much as he pleases. Let him bring over half a million of men if he likes. He can effect nothing. We command his debouches from his base. Whenever we can recover the command of the Channel he must withdraw from it precipitately or surrender at discretion.

16. *If the enemy secure his power of debouching from his base, obstruct his march and gain time.*—Careful preparations should be made in advance, and rehearsed frequently in peace manœuvres, for checking the enemy's march on London from any point where he may have effected a landing or established himself on the coast. He should be compelled to move in as closely concentrated a mass as possible, instead of occupying a large front and covering many parallel roads. He should be prevented from supplying his troops with provisions or forage *en route*, or from gaining information as to our movements and position by sending out reconnoitring parties. He should be perpetually met and harassed in front, flank, and rear, by day and by night, to impede his march and exhaust his troops with continual duty. Railways and roads should be obstructed and blocked, rolling stock, wagons, and carts removed or destroyed, telegraph wires cut or carried off, bridges blown up, canal embankments cut to flood the country. Above all, careful and stringent measures should be taken for enforcing the proper execution of orders which will have been issued through the local magistrates and police, as to the driving away of horses, cattle, and sheep, and destruction or removal of grain and forage, in order that the enemy may not be enabled to horse his artillery and wagons, or to feed his troops at our expense.

All these objects can be best obtained by the equipment of a strong force of mounted infantry, and mounted engineers, or pioneers, to assist and supplement the action of our existing regular cavalry and horse artillery, as well as of the yeomanry cavalry, who are a valuable force and ought to be encouraged.

It is a most fortunate circumstance that the enemy is certain to be weak in cavalry. For the sea transport of great numbers of horses is such a difficulty, and so many will be required for the large number of guns and wagons which will be a necessity for the expedition, that he cannot afford to bring a strong force of cavalry as well. If the value and importance of mounted corps of volunteer riflemen were properly recognized, and suitable special encouragement given by the Government to them, there would probably be little difficulty in raising a considerable body of them. But I here submit that any deficiency in their numbers could be and should be supplied in time of war by arranging for the transport of specially selected battalions in wheeled vehicles hired for the occasion.

12,000 volunteer infantry and engineers specially mobilized might be divided with advantage into, say, six brigades, placed under the

command of selected and capable Officers. The yeomanry cavalry available might be divided between the brigades, so that each would have a proportion of them to serve as scouts, reconnoiters, and advanced guard. These flying brigades, each about 2,500 strong more or less, would then act either singly or in combination according to order against the enemy's front, flanks, or rear, and against his communications. Their leading duty would be to second and support the action of our advanced division of regular cavalry and horse artillery, as well as of any mounted infantry of the regulars who may at any future time be provided, in watching and checking the enemy's advance. To these they would render such efficient support that the united action of the whole force would be invaluable. The enemy's small force of cavalry would be driven out of the field and everywhere forced back on his infantry for support. He could not raise an ounce of provisions from, or gain any information by cross-examining the inhabitants of a town lying only a few miles to the right or left of his main line of march without sending a whole Division for the purpose. Any ordinary detachment would be forthwith surrounded and shot down or taken prisoners. If he leaves detachments of moderate strength to guard his line of communications, they too will be overpowered and cut off. And if to meet this he detaches strong bodies, these will most seriously weaken his main force for the approaching struggle. The advanced division of cavalry and horse artillery will be so strengthened by the co-operation of some of these flying brigades of infantry at any required moment, that instead of being obliged to retire before the advance of the enemy's infantry skirmishers, it will be capable of offering everywhere a stubborn resistance. This will enable them in turn to lend the most material aid and assistance to the more serious operations of the advanced Corps d'Armée, consisting of our regular troops of all arms, to whom will have been allotted the onerous task of meeting and checking the enemy's advance, so as to gain time for the works in progress nearer London, and for the organization and arming of the great masses of men whom we shall then be raising.

Before leaving this subject of checking the enemy's march, we might here deal with the very important question of an attempted turning movement on the enemy's part, with a view to attack our defensive lines at an unprepared or less prepared part.

It will appear, I think, on consideration that there is very little room for apprehension on this score if we give ourselves credit for only the most ordinary and moderate amount of foresight and activity. For, in the first place, the portion of our general defensive position which will have been put more especially into a state of defence immediately on an enemy's landing in force will not be a small or confined one. It will probably be not less than 30 or 40 miles in lateral extent, comprising that whole section or zone of our position which lies directly open to his attack. On this section of the defence will be concentrated the men, guns, ammunition, and stores of all kinds necessary for the approaching struggle, while large gangs of civil workmen will be everywhere opening up communications, throwing

up provisional works, and making preliminary preparations for its defence. These preparations will be everywhere pushed to a point at which a very strong defence is actually ready or could be completed at short notice, leaving as much as possible the demolition of houses and destruction of valuable property until it is seen to be really necessary. As the enemy advances, his objective point will be defined within lessening limits every day. The defence can be drawn in and concentrated to meet him accordingly, and increasing numbers of workmen will be taken off from the sides where it is seen his attack will not fall, to push on the works at those positions where it may fall. As the enemy nears our defensive lines, he will thus have immediately in front of him a position in a complete state of defence, flanked on each side by sections so far forward that they too could be rapidly completed if required to a similar condition, with good free lateral communications and facility of movement for men, guns, and stores everywhere.

Now any kind of turning movement on the enemy's part must be either a strategical or tactical movement. If the former, *i.e.*, a flank movement undertaken while he is yet at a distance of one or more days' marches from our line, we have every possible facility for conforming to his movements and establishing an equally good defence in the new position. For we have only a few miles to move our defence, *with all the conditions necessary for a rapid movement carefully prepared beforehand, always supposing that we wake up to the necessity of such preparation now in time of peace*, whereas the enemy has a far longer distance to traverse over roads and ground carefully prepared with every kind of obstacle, both active and passive, to delay him. Moreover, the ground in England is generally close and difficult, and provides abundant facilities for delaying his march. We are bound, therefore, to be well beforehand with him, without giving ourselves credit for anything more than an extremely moderate amount of military resource and activity.

But if the enemy is to undertake a tactical turning movement when within striking distance, he will commit himself to one of the most difficult and hazardous operations in war, merely to arrive, if he be successful, at a point of our position only a short stage, if at all, behind the rest in preparation and readiness to receive him.

On the south or most important side, such a turning operation will be above all impracticable, as there the position which we have selected gives us an unrivalled vantage ground of observation, from which the whole country southwards towards the enemy can be clearly seen for many miles, so that we could not fail to discern and defeat such an attempt in any ordinary weather, apart from any question of advanced guards, outposts, and reconnoitring.

17. *Fight on the prepared line of defence.*—I refer to my first paper for a discussion of the general conditions of the defence, which we have no time here to go into further.

18. *If the line of defence be forced, rally on the reserved fighting positions, hold on to the Thames and entrenched camps, organize street fighting on an immense scale, and defend London house by house.*—It

has already been said that the reserved fighting positions, if constructed, are to be regarded mainly as a certain means of arresting the enemy's victorious progress after the outer line has been forced, and gaining time thereby for the organization of street fighting. The real and ultimate defence of London, in my view, lies in its vastness, and in the almost unlimited capabilities it presents for street fighting on a gigantic scale, coupled with the extreme difficulty of surrounding or investing it, and the fact of its being divided into two independently defensible halves by a formidable and very defensible obstacle, viz., the Thames.

I ask you to consider this question. If a mere handful, comparatively speaking, of Communists, the scum of Paris and of Europe, made such a formidable defence of Paris that they were only overcome by a very large army of regular troops after severe fighting extending over several days, what number of invaders will be required to take London, supposing the vast city to be defended house by house by the whole power of England, directed by our ablest Officers, and supported by all the resources of the country poured in by rail on the uninvested side?

Let the enemy make good his landing on our shores, which is always possible, and which no reasonable development of our naval strength can apparently be relied upon effectually and under all circumstances to prevent, considering the many unknown and uncertain elements in modern naval warfare. Let him march on our capital and beat us everywhere in the field, a contingency which, considering the immense comparative superiority of Continental armies over our small and composite forces, it would be folly not to reckon with. Let him force any prepared line of defence round the capital of which at present we have none. Let London lie open before him. If the spirit of Englishmen be then in the future what it has been in the past, the hardest task of all will then still await him, and the real struggle will be only just commencing.

The enemy will be everywhere confronted by high and strong barricades of stones and earth, defended by artillery and machine-guns, and flanked on each side by loopholed houses all down the streets, giving a deadly cross-fire. He cannot storm these barricades. If he attempt it, his loss of life will be enormous. He cannot storm them nor can his field-guns level them. He must mine and sap through the houses on each side to turn them, and where he can mine and sap we also can mine and sap. Every yard of his path will be attended by the explosion of our defensive mines. No doubt he can riddle and destroy houses by the score with his artillery, but this will not take the barricades. And we shall also have guns on our side and of larger calibre than his. When, after infinite labour and great loss, he has secured a line of barricades closing the streets immediately in front of him, it will be only to find another line of still stronger and better prepared barricades a little further on, and so on to any extent. His men will fall by the hundred and by the thousand in such a struggle. If he advance boldly, determined to get on, his loss of life will be enormous, and will soon

bring him to a standstill. And if, to avoid this, he feel his way cautiously step by step, looking everywhere for mines and searching every house for riflemen as he goes, the work will be so interminable and laborious, that the best troops on the Continent would soon be utterly sickened and worn out by it. For to capture a vast city like London in such a way would be an affair not of days but of weeks, with men falling by the thousand every day. Any reasonable number of invaders would find themselves buried and lost in a vast mass of ruins representing the ground already won, with a still vaster mass of barricaded streets and loopholed houses everywhere in front of them representing ground yet to be won. It is a very doubtful question, I think, whether any number of men which a Continental invader could undertake to bring over could take London defended in such a spirit, and apart from any aid from special defences of any kind, provided always that we hold on strongly by land and water to the line of the Thames as we are bound to do, and provided we make such a continual stubborn fight everywhere and all around as will force the enemy to move in concentrated masses, and thereby prevent him from investing the city and compelling it to surrender by starvation.¹ We might succeed in this, but it is certainly a very open question whether we can expect to do so without the aid of entrenched camps, and a second arsenal at a distance from Woolwich, the need of which we will next consider. In any case, if we are to succeed in such a struggle, we must be prepared probably for very sweeping and stringent measures at an earlier stage for diminishing the food supply required, by sending a part of the population of London, especially those on the threatened quarter, away to other parts of the country by road or rail.

Above all, we must gain time for organizing the work. For such a defence to be successful against the trained and disciplined armies of the Continent must be systematic, and well organized on an immense scale. The vast circle of defence must be divided and subdivided into zones and sections under able and determined Officers, who must have unlimited authority to remove non-combatants, blow up or demolish buildings, barricade streets, cut off or lay on gas and water supply, and carry out every necessary measure under the direction of a Commander-in-Chief, who would be practically a dictator for the time. All this cannot be arranged in the actual presence of the enemy, and we must take such measures in advance as will enable us to gain a few days or a week before he can appear.

The misery and ruin inflicted on an unoffending civil population by such a defence of London would of course be enormous. Very possibly the country would not have the courage to endure it, though

¹ We cannot of course afford to allow London to be invested. Once it is invested its doom is sealed. It must forthwith surrender. But my argument is that, although we may not be strong enough to meet and beat the enemy in a pitched battle and in the open, we may yet, by holding on strongly to the line of the Thames and to the entrenched camps, succeed in confining him within one zone or sector only of the vast circle required for investment. We must also protect the water supply of the capital, and to that one or two of the permanent forts, if not one of the entrenched camps, should be devoted.

I am inclined to think that we could and should do it if we could only gain the necessary time. In any case the suffering and risk of failure involved would be sufficient to take away all possible excuse for presuming upon such a defence in advance, and thereupon neglecting our present preparations. We ought by all possible means, and beyond all question, to take such measures now in peace as will enable us to avoid the necessity of such extreme courses, and if we do not do so, whatever may happen, we deserve to fail.

19. *If the enemy be everywhere victorious in the field, the ultimate defence of London, and the possibility of continuing the struggle if it be captured, will best be secured by the construction of entrenched camps at commanding points round it (see Stage 9, above), and by a central arsenal at a distance from it.*—Having already dwelt upon the importance of these entrenched camps as part of a thorough and complete system of national defence, I cannot here afford to say much more about them. They will immensely improve the defence of London by very largely increasing the difficulty of investment, and forming strong centres and rallying points of defence at wide intervals apart. An enormous number of men, probably a million, would be required to invest the capital, and with such a force against us the final result would still be doubtful and uncertain. I am here assuming, of course, that much time will be occupied by such large and extended operations as would then be necessary on the enemy's part, and that meanwhile we shall be raising men by hundreds of thousands to oppose him.

If, then, we had besides the entrenched camps a large fortified central arsenal to keep up the manufacture of munitions of war and replace Woolwich, which would probably be one of the earliest points attacked by the enemy, we should have a very good chance of final success, whatever number of men might be brought against us. The food supply of our population will then be our leading difficulty, but the measures now in progress for protecting our leading commercial harbours will go a long way to meet this.

Concluding Remarks.

Table I contains such a complete analysis of these papers that it is not necessary for me to take up your time any further by a recapitulation or summary of what has been said.

I would, however, make a few observations on some of the leading conditions, which will go far to determine our success or failure in the defence. These are—

(a.) *The time available for organizing defence subsequent to an enemy's landing.*

Time to organize our defence and bring up our men is of such importance to us that I have already urged that the defence of that portion of our coast-line comprised between the mouth of the Thames and the Medway on the south and Harwich on the north—sufficient to prevent an enemy from effecting a landing in force upon it—is a primary necessity of our position at present. For if an enemy be allowed to land in force, say, at the mouth of the Blackwater, he may in two days seize a commanding position on the high ground between Epping

and Romford, from which he can overlook the capital and be in London itself the third day before we can muster our troops in sufficient force to stop him, or organize the stubborn and systematic street fighting which has been advocated above. When this portion of our coast-line has been efficiently protected and we have in addition a fortified *tête-de-pont* to secure the passage of the Thames at Tilbury, so as to threaten an enemy's flank in any such operation, we shall be in a far better position. Meanwhile it seems likely that the necessity of such protection will on the outbreak of a serious war be so evident that no Government who may then be in power can afford to neglect it, at least so long as the capital itself remains unprotected and defenceless. I shall assume, therefore, that at such a crisis detachments of our naval and military forces strong enough to secure this portion of our coast-line will have to be tied down to guard the estuary of the Thames and adjoining coast towards Harwich. From a general or imperial point of view this is very objectionable, but as things are at present it seems inevitable.

But if this portion of our coast be guarded one way or other so that a descent upon it becomes too risky and uncertain for an enemy to undertake, he will be driven to land either on the south-east coast below Margate or else north of Harwich, and most probably at some point of our exposed southern coast. In this case he ought not probably to come actually in front of our defensive line protecting London under a fortnight. But this again depends entirely upon the efficient organization, extent, and success of our measures for checking and delaying him. This is why I have devoted so much space in this paper to a consideration of the best means of so doing.

(b.) A leading point to which I would here invite your special attention and would propose as a fit and most important subject for discussion is this : that in my view *all our arrangements for the defence of England under present conditions as regards our military strength should be based upon and should lead up to the defence of London on a line forming a continuous circle round it. This should be laid down by authority once for all, and every year something should be done, whether by the execution of necessary works and defensive preparations, or by rehearsals and practice on the part of the troops who are to man it, to strengthen, perfect, and complete its defence.*

I ask you to consider carefully this most serious question : Can we afford with our present small forces consisting of a composite array of troops, in all stages of efficiency and training, to stake the fortunes of the Empire on the defence of any position intermediate between the coast and a strong and carefully prepared reserve position for the defence of London, seeing that we might be turned, outflanked, or outmanœuvred out of such an intermediate and isolated position, and in any case it could not be nearly so strong as one forming a section of a continuous circle of defence round London, and carefully considered and prepared at leisure beforehand for the purpose ?

The programme which I have had in view all through, and which I submit to your judgment as the only sound one, is this : that we should fight to forbid an enemy from landing, or to prevent him

from acquiring a base, or to shut him up in and prevent his debouching from his base if he does capture one. After this we should confine our efforts to delaying his march, to checking and circumscribing all his operations as much as possible; and we should reserve all serious fighting till we can fight on our leisurely prepared and thoroughly well understood position surrounding London.

(c.) Let me now say a few words upon a very important and fundamental question, namely, the necessity of regular works of any kind to defend London. "If," it may be said, "your defensive position surrounding London will be so strong as you say it will, then why spend a far larger sum in addition in permanent fortifications; is it that after all you have no faith in your proposed defence?" Not so: I believe that such a defensible position as I have advocated will, when manned by our available forces of all kinds, give us a secure defence; and if not, it should be strengthened on the same lines till it is strong enough. But though it may then be amply strong enough, it does not therefore follow that the fortifications are unnecessary; far from it. For it would then still remain vicious in principle from a general strategical point of view, and viewing the defence of the country and Empire as a whole, that such a large proportion of our total fighting strength should be required for the defence of our capital alone. We should still require the regular works to economize men, to render our capital defensible by a moderate garrison assisted by a moderate field army only, and to set free the large number of men not then included in the necessary garrison of the capital to meet the many other pressing demands which are sure to arise in various quarters at home and abroad. It is a mistake permanently to tie down the bulk of our whole fighting strength to the defence of our capital, though at this moment and for some time to come it is inevitable. Our capital should be rendered independently defensible by a moderate force aided by suitable permanent works, so that the bulk of our forces may be sent elsewhere as required.

As regards the cost of my proposals, I have confined myself to a rough estimate of the items included under the defence of London proper, which has been all along more immediately in view.

It will be seen in Table I that the cost of the items included under Stages 1, 7, 8, and 9 amounts to about 4,000,000*l.* If to this we add 500,000*l.* for the items comprised under Stage 2, which are so directly connected with the defence of London that they might well be included in it, we obtain a total of 4,500,000*l.*

This sum should secure our capital for generations to come against any attack.

But I hope it will have been clear to you that of this sum only a moderate fraction, namely, 900,000*l.*, is proposed to be expended all at once.

The items representing the remainder of the money should rather be dealt with after other necessary services, such as those detailed in Table II, have been fairly attended to.

If any member of this Institution considers that a strong and patriotic Government, with a due sense of the immense importance of

the subject to England and to our whole vast Empire, might most justly and reasonably ask the House of Commons to vote the whole 4,500,000*l.*, and make a good job once and for all of the defence of our capital, I shall not be in the least likely to quarrel with him. But for the sake of economy, and in order that my proposals may not be considered extravagant, I have here been much more modest, and advocated only the immediate expenditure of a far smaller sum.

In conclusion, I once more desire to commend this subject, namely, "the necessity for defending London," to your consideration, hoping that whatever view may be taken of the merit of any of the proposals which have been submitted to your consideration, this at least may be generally agreed on, that our capital, the great centre, focus, and heart of our vast Empire, a magnificent prize to tempt and entice any enemy who, in the absence of our fleet or on obtaining the temporary command of the Channel, can make a sudden swoop upon it, ought not to be left any longer defenceless.

Mr. TRELAWNEY SAUNDERS : I am afraid you will feel that this is a case of "fools stepping in where angels fear to tread," but I confess that my audacity has been stimulated by the very opening of the first portion of this paper, in which Major Elsdale speaks of "the apparent indifference of the British public to the most important and vital questions connected with the defence of the Empire, and the languid and fitful interest displayed in them by the Government," as the motives which have induced him to take up this question. Now, Sir, that is scarcely just to the British public, for you can hardly look at the existence of our Volunteer Force and then say that the British public are indifferent to the defence of the Empire, and it has surprised me in the course of these lectures, that in speaking of the Government, so little has been said of what the Government has done as a very first step to the discussion of such a question as this, in the general survey of the country upon a most useful and practical scale. The 1-inch map which was begun at the commencement of the century is now undergoing complete revision, and yet the 1-inch map itself is really the basis upon which our engineers have been content to lay out the preliminary arrangements of great railways and other public works, and it is certainly a work not indicating any negligence of the Government with reference to that branch of the subject. But since that time we have had maps on scales of 6 inches, 12 inches, and 5 feet to the mile, completely laying bare every road and footpath in the country, and answering questions such as those which have been started by the lecturer, especially as to the communication for the defence of London. But, Sir, I think the public at large will scarcely be enamoured with a proposal that would commit them to such enormous works of defence, works of defence that must at all events be mainly theoretical, and that may not be called into action, for that must depend upon the course that the enemy may take. And moreover, I consider, for my own part, that at the present moment when the mind of the country is being directed towards the more close connection of the Colonies with the mother country, the union of the whole of the Monarchy under one general system of administration, it is unfortunate to let it be supposed that the centre of Government is more anxious about itself, about the defence of London, than it is about the Monarchy in general. And even if the defence of London be everything to us, and I am not going to minimize the importance of that defence in the slightest degree, but if the defence of London be of such great importance, still, Sir, I think it is not of such great importance that we should overlook the defence of the more exposed parts of these British Islands, I mean especially our coast towns, which possess considerable populations, considerable wealth, and are in themselves of considerable importance even to the metropolis itself, and therefore I would say that the first point to which our

attention should be especially directed is to the defence of our coasts. And when I recollect what took place in the last great attempt—I put aside the Boulogne affair under the first Napoleon—the last great attempt to effect a landing on these shores, the attempt of the Spanish Armada, I should like to see the course that was taken on that occasion repeated on any future one. What took place then? We did not wait for the enemy to land, we collected every vessel whatever its size might be, every vessel that could carry a man and a weapon, and we rushed out into the Channel to meet our enemy on the sea, and that is where the battle for the defence of London ought to be fought, and for the defence of our shores in general. And that appears to me to have its foundation laid in the fact that at the present moment every yard of our shores is under patrol night and day by our coast-guard, and if you would only work upon that basis, and constitute a system of what might be called Marine Volunteers, using our coast-guard stations so far as necessary as depôts for the training of these Volunteers, and encouraging our gentry to provide whatever vessels or platforms for working weapons of offence may be desirable, leaving the selection as widely open as possible, until experience has shown us in what direction some general system should be introduced, I say that in that direction we should offer to an enemy a more terrible opposition than any that could be afforded by a land force. How should we meet an enemy, Sir, in such a case? Recollect what he would be composed of. He would be composed largely of land forces, and the poor creatures would be half dead with sea sickness to begin with. I contend we should be meeting them under the best possible circumstances. Just as our forefathers, Drake and Hawkins, and the rest of them with their little vessels attacked the big galleons, the equivalents of the ironclads of the present day, without considering whether they were bigger or smaller, so I say with the force we could bring to bear upon any force that could be imagined as venturing into the Channel to attack our shores, there could be no question as to what the result would be if such weapons as are now at our command were only brought to bear upon such an occasion. And moreover, Sir, recollect that such a method of defending a coast-line is as available for any maritime Colony as it is for ourselves. And I do say, considering the great aim we have of uniting the Monarchy under one common administration, and considering also that the limit of nationality is the capacity for a common defence, that unless you can show that the defence that you would apply to the British Islands is a defence that can also be applied to our Colonies, you hardly make out that common defence which ought to be the common bond for the whole Monarchy. I am afraid I must not take up your time much longer. I have touched upon what I consider to be the main points that I wish to offer to you. I should like to say one or two words more, for instance, Sir, I think in such a question as coast defence, a very important use might be made of a corps that stands second to none in its services to the Crown, and that is the Marine Corps. And, sir, I would say that such an employment should be made of the Marine Corps as to add to the value of the regular forces. For instance, I would add to the Marines an Engineer Corps, and I would place the whole of our maritime fortresses under the Marines, and would liberate entirely the regular forces from garrison duty. I would no longer consider the regular forces as a defensive force at all, and would treat them entirely as an offensive force, and I would connect them also with a permanent transport service, that should enable us to place 30,000, 40,000, 50,000, on any part of the Continent or any part of the world where they might be most wanted for our purposes. That would be a use of our regular forces trained and disciplined to the very highest extent; and that would be a use of our small army that would make it more powerful than the largest army that the Continent could produce because of its mobility, because of our capacity, which no Continental army would possess, of moving it by means of the sea to any point where it was required.

Admiral Hon. E. R. FREMANTLE: I am very much disappointed that we have not here amongst us military men who will speak to the elaborate details which have been brought before us to-day by Major Elsdale. It will probably be caused by their having spoken on the previous occasion, and I may at once say that I do not feel myself at all competent to touch on many of those questions which have been certainly very elaborately threshed out by my friend Major Elsdale. I feel

are that every person here present would wish this to be a not merely academical discussion, and that we should not go away merely passing compliments, as I see as stated the other day, but that we should say exactly what we mean. If we are to produce any impression on the public this must be a real discussion, and persons who take part in it should say really exactly what they mean. Therefore, I shall perhaps be excused if I say exactly what I mean, and I should begin with these tables, and I should ask to read down to the first comma. "Decide upon a continuous circle of defence around London, to be held at any point by our existing forces," and there I should stop. Although I speak as a naval Officer, and have a very high appreciation of the Service to which I belong, I think at all events I am speaking from a national point of view, and from no mere narrow professional feeling, when I say that the defence of this great Empire must be left mainly and principally to the Navy. That I think is admitted generally enough by the lecturer. The lecturer mentions Baron von Scholl, the Austrian strategist, and says the proper defence of London, in his view, is on the high seas or at the coast, and not in works near London. To elaborate a little further what my views are I should say distinctly we do require defence at the coast or near the coast. I should certainly say if any enemy did have the temerity to land our object should be to drive him into the sea, and we should also endeavour to box him up if he should hold any harbour or strategic position. Further than that I do not think I should be inclined to go, except that I do think the Government should, and I have no doubt the Government has, and I do hope that all Departments of our Government, and I hope our gallant Chairman will be able to tell us that the Government have considered the question as to what defence we should make in what I must consider the extremely improbable contingency of an enemy landing in force on our shores, so that we should be able to make some resistance to him. It is scarcely worth while for me to point out how extremely centralized everything is in this country, how we are dependent so entirely upon our over-sea stores. It has been pointed out over and over again that we possess but a very small food supply in this country. Right or wrong, in recent years the progress of our policy has been to make us more and more dependent upon over-sea supply for our daily bread. Under these circumstances I do think that if any hostile Powers were to have for a certain period, even for a short period, the command of the seas, not only would our Mediterranean garrisons be necessarily overpowered, not only should we probably lose India, but we should be simply starved out at home; and under those circumstances I do not think it very germane to the question of the defence of this great Empire to treat it as a possibility that we should be able to maintain a siege of London. But, as the lecturer has said, the capture of London by an enemy means that that enemy has got us by the throat and can force his own terms upon us. The lecturer asks whether "any well-informed naval Officer thinks the Navy has ever been in this generation, or is likely to be in the immediate future, strong enough to protect our vast commerce all over the world, to ensure the safety of our food supply, to meet and beat any possible enemy's ships on the high seas." I cannot answer that latter question. I do hope that we are strong enough to do so. This I am quite certain of, we shall do our best to protect that large commerce, and if we are incapable of protecting our commerce and the food supply of this country I am afraid we shall have to submit to whatever terms a foreign Empire may impose upon us. But if I digress for one moment from what I have stated, namely, that I do not feel very competent to touch on a regularly military question, it is because it sounds to me very much like a challenge when the lecturer says that any enemy taking London would have grasped England by the throat. Now if one only thinks for a moment of the configuration of these islands one would see it would be quite possible to adopt all that the lecturer has proposed, and still that England would be very decidedly grasped by her throat. The way would be naturally by the seizure of Hull and the occupying of all our great centres of production, of the great manufacturing cities, such as Manchester, Leeds, Liverpool, and Hull, and with these in the hands of the enemy unquestionably we should be grasped by the throat. It seems to me the country would be cut in two, and under those circumstances we should have to submit to almost as bad terms or quite similar terms as if London itself were seized. Therefore, I do think we should

direct our attention more to the subsidiary parts of the lecturer's programme, those that touch upon the proper organization of our troops and upon what may probably be done, rather than go into the question of spending money in the directions which have been principally pointed to, I am afraid, by the lecturer. I am quite aware the lecturer in coming here to give us his views has given us some very valuable and very important views. I am quite aware that he has shown a great deal of energy and ability, and that with regard to many of the details which I have ventured to say we should leave out—I only venture to say I should leave them out because they cost money—as I am aware that they are very valuable, and will be very valuable to anybody who undertakes to say what should be done in the case of the possible invasion of this country or the prevention of its invasion. Therefore, I should say distinctly I should not protect London by special works. "Are we prepared to throw upon our Navy, or upon any coast defences, or upon both combined, the tremendous responsibility of the protection of London?" I should say distinctly upon both combined, and I should say further that I should naturally differ from the lecturer when he says, "whatever be the struggle in the north of England we should have secured our capital, and that would be an enormous gain." Now I consider that that gain would not be an enormous gain, nor would it be, I may say, much worth consideration. Before I sit down I should like to summarize what I have stated. I do hold to a great extent with the poet that "our home is on the ocean wave," and that we do not need too many bulwarks. It must be apparent to every one of us that all nations when they begin to go down think more of their defences than they do of their offences; they think more of those things that can be produced by money than they do of what can be produced by bone and sinew. I would only refer on this point to such cases as the great wall in China or the wall against the Picts and Scots which the Romans erected in this country. I hope what I have said is not painful to the lecturer; I have a very high opinion of him. I have had the pleasure of his acquaintance, and I hope to retain it. However, holding these views as I do very strongly, I have ventured to bring them to public notice in order to make people understand clearly that we do not come here for academical discussions, but that we say candidly what we think with reference to the questions brought before us.

Major H. H. CROOKENDEN, R.A.: It is quite possible to imagine that a combination of European or foreign Powers could, with the aid of their fleets, overpower ours for a time, that our own vessels would be driven into the dockyards which are, or ought to be, at the present time properly protected by fortifications, and that during a short time, say from two to three weeks at the outside, these vessels would be repairing and refitting, and during that short interval this combination of European forces, or even one force possibly having command of the Channel, should disembark a force upon our shores. The very want of food in England that has already been touched upon would, in my opinion, force the enemy to bring all his food with him, and his inability to make requisitions upon the country as is usual on the Continent would, I take it, limit the campaign to seven days, that is, allowing two days for disembarkation, and five days for his march towards London accompanied with fighting. If any more lengthy operations were undertaken I imagine that our vessels would then have been able to repair and refit in the dockyard, and would assail the ships bringing his supplies, and hence the enemy's absolute necessity for a speedy conclusion of the campaign. I cannot imagine that any satisfactory result should ensue from any fighting on the coast. Assuming that the enemy has landed I cannot conceive that there would be anything but waste of men and material in attempting to harass him there, though no doubt our advanced cavalry could by desultory fighting retard him enormously, notwithstanding the large number of roads which would be at his disposal. If he has once command of the Channel he will disembark when he pleases and where he pleases, and, in my opinion, without opposition. His own vessels would keep off the gunboats that the lecturer has referred to to-day which are supposed to be armed with long-range guns, I mean the gunboats of light draught, so that they could hardly co-operate in preventing or harassing his landing. Upon this ground I take it the security of London against a *coup de main* virtually settles the whole question. If the military road suggested is once constructed so as to surround the

capital and the defensible stores of ammunition and arms made, the rest would follow of itself. The most vulnerable point round London is undoubtedly on the Essex side, and this is the side that has the least natural strength, and the one to which the greatest attention should be paid. Lastly, I would point out that there is at the present moment no mobilization scheme whatever. There is an old one which was published in 1881, but this virtually is a cypher. The 2nd and 3rd Army Corps are largely composed of militia battalions belonging to Ireland, and these have not been called out for training for several years.

Major FEATHERSTONHAUGH, R.E.: I should like to say one or two words respecting a *coup de main*. The point to my mind is from what direction is the *coup de main* to come? It will not come from the north-west, the west, or the south-west, that would not be a *coup de main*, for it would be going a long way round; it must come from the north-east or south-east. Against an attack from either of these two directions I believe the position of Chatham is a perfectly strong enough defence. If you have at Chatham as many men as you can possibly get together they can either cross to the north at Tilbury to take in flank any advance from the north-east, or if they stay at Chatham they will be on the flank of any force advancing from the south-east. That being the case, in a country like England where it is so inclosed, and there are so many facilities for throwing up works, I believe that our Army could always place itself across an invader's path and at one day's notice make as good an entrenched camp as in a fortnight or more. Look for instance at Plevna, that position was taken up in a hurry, but it kept off the enemy for weeks. The defence of Petersburg was a similar case. I saw the defences of Petersburg, and they were very slight. In the place where most of the fighting was the troops were about 300 yards apart, and the rifle firing went on day and night in order to prevent a surprise. In the other parts where the works were certainly better no serious attempt was made to attack them. That siege lasted seven months, and Petersburg was never taken in the real sense. Therefore I consider the English Army under the above circumstances would hold the enemy until his attempt was no longer a *coup de main*, but a serious siege of London; and that being the case we come to the second part of the paper, the defence of London against something more than a *coup de main*. I should be afraid the measures Major Elsdale recommends would, in the mind of the public, produce the impression that London was defended when it was not defended. Although I am an Engineer Officer, and although "there is nothing like leather," I think it may be said that there can be no doubt that fortifications will keep out troops. The Metz forts were never besieged, they were only invested; the siege of Paris was the same thing. Therefore if you have fortifications of the right kind I believe London would never be taken except by investment, in which case we must assume that the English fleet is destroyed or driven off, and the country is held on all sides. That being the case, then permanent fortifications would be of great use, as they would preserve London while the army went about to try and protect the rest of the country the best way it could. The point I wish to take is that these mitigated measures which Major Elsdale has recommended might be a danger; they would make people think London was defended in the right way, whereas it was not defended, and, in short, I think that as against a *coup de main* they are not required, and as against anything more serious they are not sufficient.

Lt.-Col. ROGERS: I have not had the pleasure of hearing the lecturer, but I have read the lecture. It is a curious coincidence that fourteen years ago a book was published in London called "England rendered Impregnable," in which a very similar system for the defence of London was advocated as that laid down by Major Elsdale, namely, field works erected here and there within a radius of 30 miles, and defended chiefly by machine-guns. In his lecture Major Elsdale has made no mention of the fact that the enemy who advances on London will unquestionably be in possession of machine-guns. In this country I believe the Gardner machine-gun has been adopted, but the enemy may be in possession of a far more efficient weapon, in my opinion, the Gatling, and for this reason, that the improved Gatling is capable of high-angle fire which will certainly shell out the men manning the T-shaped entrenchments where the Gardners or the Norden-felts would be. This is the one point that I wish to bring before the meeting, for

unquestionably machine-guns would be invaluable for the defence of such a large district as the surrounding neighbourhood of London, and also they would be useful in the event of the army being withdrawn from Ireland, because there is no mistake but that they would do the work for the army so withdrawn.

General COLLINSON, late R.E., who was present at the first meeting, but was obliged to leave, and was unable to be present at the second, sent the following notes, which, by permission of the Chairman, were read by Major Elsdale.

THE DEFENCE OF LONDON.

I should wish first to express my satisfaction that Major Elsdale has undertaken this paper; as from his essay on "the Causes that have led to the Pre-eminence of Nations in War" (on which occasion I was one of the judges), I formed a high opinion of his comprehensive views, and of his power of dealing with the details of a subject. The part that I heard of the present paper confirmed me in this opinion. My observations will be on certain prominent points of the subject.

1. *The Value of London.*—On this head I beg to draw attention to an important paper by Sir E. Du Cane, R.E., in the "Fortnightly Review" for April. He quotes the high authority of Mr. Giffen for the statement that the value of all the property and money in London must be about *one thousand million pounds*. If this is at all near the mark, the ransom that would be exacted by a conqueror for sparing it would, in money alone, be such amount that probably the mere interest of it for one year would be far more than the sum calculated by Major Elsdale for putting London in a state of security by permanent works.

2. *The Character of his General Propositions.*—He proposes to begin with such slight works as he can get money for, trusting to be able to make them fully efficient when money is available. I think we ought to state clearly our opinion as to what is necessary for the absolute security of London, and leave it to the executive advisers of the Government to determine how and when they are to be carried out. I think we should not put forth any ideas with the authority of this Institution (for a certain authority attaches to papers read and discussed here) that will lead the people of this country to imagine that the kingdom can be secured from invasion without great undertakings, fully considered, taking years to mature and requiring a great deal of money and men.

Two Lines of Invasion.—Major Elsdale is right, I think, in this distinction. An enemy or combination of enemies might make their preparations openly in time of peace and ostensibly for other objects, and when all was ready the declaration of war and the invading armada would leave together. In this case we should not have more than a fortnight to prepare. Now, there are two certain difficulties, whatever our preparations, that we must always expect to find. 1st. The enormous pressure on the Government departments for matters not fully provided for. 2nd. The delay of the Government in moving at all. Hence it is important that even for resisting a *coup de main* nothing should be left to be done at the time which can possibly be done beforehand. Or the enemy may wait till a period in the war comes when we may be weakened and distracted by distant undertakings, and then make the attempt with fuller means. Our defences must prepare for both these cases, and that should be clearly laid down at the beginning. And as in the latter case the period of threatened invasion may go on for months, that difficulty will have to be taken into consideration in allotting the Volunteers. It cannot and ought not to be expected of Volunteers that they will remain away from their business for twelve months continuously.

The Volunteers.—I agree that they are the only force we have to look to to defend London. But it will take every Volunteer present and possible to do it if reliefs are to be provided for, and the line of defence is to be more than 100 miles long. And then over and above the garrison of London there are the garrisons of our great fortresses, and of the forts at the principal harbours and round the coast; and beyond that the field army, and beyond that the force to line the south-east coast along that 150 miles of dangerous proximity to the capital. For all these various requirements, and all of them must be manned to some extent, we ought to be able on declaration of war to put at least a *million* of men under arms

for the defence of the kingdom only. We cannot call on the Volunteers to provide this number; it would be unfair and unsatisfactory.

The Line of Defence of London.—I do not see any objection to the length of the proposed line of defence; indeed, I agree with Major Elsdale, that it ought thoroughly to include the Thames and Medway. The port of London is fast extending to Gravesend, and would offer a large booty to an invader in the docks and warehouses of the lower reaches, and we should keep up the connection between London and the sea. There should be no difficulty in a densely populated and exceptionally rich country like ours in providing both the men and the money to carry out all the above-mentioned branches of the defence of the kingdom. Not to do so would be encouraging possible enemies to think that we considered the defence to be something beyond our powers. In such a long circuit of defence it may be desirable to form completely entrenched camps at certain favourable positions round the inclosure.

Character of the Works.—It is on this head that I differ from the lecturer. He is inclined to trust to what we must call field works manned by Volunteers for resistance to a *coup de main*, and apparently he is willing to leave a considerable portion of these works to be executed after the declaration of war. For reasons before mentioned I strongly deprecate leaving the complete execution of any work to be done during that short period of intense excitement. I wish those inclined to such confidence would read the angry correspondence that went on for months in 1803-5 between the various departments of war as to the relative responsibility of each, and the failure of supplies that resulted thereon. But as to the character of the works, I don't think there is any authority in military history for the successful defence of field works on ordinary ground by irregular troops against a regular army. There are good instances of such defence by one regular army against another, and by irregulars against irregulars. I am ready to allow that breech-loading rifles have put a new kind of weapon into the hands of our population particularly calculated to increase their powers of defence, and that machine-guns add greatly to that power in flanking positions. But the men to work these guns must be not only intelligent and zealous as Volunteers are, but trained to firing in war and disciplined to hold together. If such training and discipline is to be got out of Volunteers, there is no need for us to have any regular troops at all. The security of the capital of the Empire must not be trusted merely to zeal and intelligence, however great. If Volunteers are to hold London against any attack by regulars, they must feel more secure behind their field works than any guns or entanglements can make them; there must be good permanent obstacles to give them the necessary confidence, and no obstacle equal to a well-covered wall has as yet been invented for this purpose. I think, therefore, that this valuable paper of Major Elsdale's would produce a much more beneficial effect on the people of this country, and produce a far greater permanent good towards the defence of London, if the pith of it was put somewhat in the form of the following propositions:—

1st Proposition.—That certain powers in respect of buildings and user over a zone of ground round London be obtained by the Government.

2nd Proposition.—That the works necessary for an efficient permanent defence be planned and be commenced and continued from year to year.

3rd Proposition.—That the Volunteers be employed by regiments or battalions, some every year upon the entrenchments, and other accessories which would be required on declaration of war to complete a continuous line of defence.

Major ELSDALE, in reply, said: The only points that I need take up your time in noticing are one or two referred to by Admiral Fremantle, the first being the very important question of food supply. If Admiral Fremantle will look to Table II, he will observe that after dealing with the most important and pressing necessities of the country, I then refer to the primary measures to secure our food supply and commerce—a fleet of fast cruisers to sweep the seas,—protection of our leading commercial harbours, and protection of our leading foreign harbours and coaling stations. I put those matters well in front of “Forts to strengthen the line of defence,” “Reserved fighting positions to strengthen the defence of London,” and “Entrenched camps.” That is to say, I entirely agree with him that the food supply question comes first, and it is of the most vital importance.

Next as regards an enemy landing at Hull, or anywhere up in the north, ravaging the country and taking all the great manufacturing towns, in my first paper I dwelt upon the probability of such a course being taken, and thereupon argued that as much as possible of the defence of London should consist of movable elements, and I accordingly provided for 180 powerful guns of position, and 300 machine-guns to be moved down as required to Hull, or any port where an enemy might make his landing, in order to put us in the best position that the circumstances would admit of for meeting such a contingency. I submit to Admiral Fremantle's consideration that if my views were adopted we should be in this position, that we should have secured the great centre and heart of the Empire against an attack by an enemy, and in securing it we should so dispose our defensive measures that they could, if required, be taken to any part of the kingdom to meet such a turning movement on the enemy's flank, and that, I say, is, on the whole, the best situation that the circumstances admit of. As regards what Major Featherstonhaugh said, if I understood him rightly, he seemed to say that the position of Chatham, taking an enemy's defence in flank from any quarter, was a special protection to London. I venture to say I cannot agree with him at all. The enemy would simply be in this position, that he would be obliged to detach such a number of his men as would be sufficient to hold in check the garrison of Chatham. He would then march straight on London. We should be in the position of dividing our forces into two, if I follow the argument rightly, one part being locked up in Chatham, because the enemy would never dream of turning aside to attack Chatham, and would merely detach such a movable column as might be necessary to check the advance of the garrison of Chatham against him, and would push on at once with his main force to take our capital. Once he were in London, if you had fifty Chathams they would not be of the slightest value to you.

Major FEATHERSTONHAUGH: What I said was, Chatham was a position that the whole British Army could use and pass through from south or north, not merely the garrison, but the whole British Army.

Major ELSDALE: There I entirely agree, because I also dwelt on the importance of Chatham from that same point of view. I rejoice to find that there is nothing of importance between us. I believe these are the only points of importance that have been raised.

The CHAIRMAN: I am sure the Institution will not ask me at this late hour to detain it with very many remarks upon this most important and interesting subject, to which, no doubt, the paper that has been read by Major Elsdale is a most valuable contribution. As to the general scope of the paper, and the remarks that have been made upon it, I honestly confess my own individual sympathies are rather with the remarks that fell from Mr. Trelawney Saunders and from Admiral Fremantle, than with those contained in the paper, or made by Officers who have supported the paper. I have in this theatre, and also in the responsible position I hold in laying any measures before the Government, laid down this one leading principle with reference to the defence of England, namely, that the defence of England and of her Empire depends upon our position being such that at any moment we can take the offensive. The very moment that you abandon that and seek to regard only the defence, refraining from a wise expenditure upon your offensive power, that is, upon the power of your fleet and your transport service, and all your mobile troops, you are entering, in my opinion, on a dangerous course with reference to the future of the Empire. I therefore hail with extreme satisfaction the expressions of opinion that have fallen from a civilian—Mr. Trelawney Saunders—who does us the honour to speak to-night, as showing that apparently in his mind, and I hope in the mind of the British public, the great hope of securing the integrity of the British Empire, the defence of England, and preventing even the foot of a foreigner reaching our shores or approaching to this great city, lies in the knowledge that England can, and will, when necessary, strike whenever she wishes and wherever she desires. With these remarks on the general question, it will not be desirable, perhaps, to go into any review of the subsequent discussion on the paper itself, but, assuming for a moment that it was desirable that we should advocate the measures which have been proposed by the author of the

paper, I may state that I am afraid, from my not small experience in works of this kind, that his estimates are below the mark. I am very much inclined to agree with Major Featherstonhaugh, that unless we entered upon a defence of this kind with a full determination upon our part to make it whole and complete, we should be again entering upon a rather dangerous course. The position of the city of London renders the subject of the defence of London by the engineer's art a question the like of which the world has never yet seen. There is no other city in the world like London, with its five or six millions of people living in houses unique in their character, for our system is that the house itself contains only one family. The result is that this city has spread out in all directions, and is still spreading, and therefore we do not know where the zone of defence that we might decide upon to-day would be twenty-five or thirty years hence. The result of this growth of London would be, that the protection which would be sufficient for to-day would be utterly useless in years to come, and the vast expenditure that would be incurred would be thrown away. Nay, more, the very fact of insisting that there should be this zone of defence to a certain extent cripples the very industry and enterprise of the country; because, in order to make the works of defence which have been proposed by the author of the paper of any value, you must reserve rights over large areas, or they would be worse than useless. The requirements of a defensive work are not limited to the site upon which it stands, especially now-a-days with these new arms ranging over far greater distances, distances increasing every day, so that the moment you come to deal with these questions in a really practical form you are led to a solution of the problem which is sure to be rejected the moment you have to deal with it in a concrete shape. I therefore still go back to the point with which I commenced, that the exceptional circumstances of this great city and its enormous population confirm the principle that the traditional policy of the country must be adhered to, and that even supposing the first line of defence, that is to say our fleet, were forced, the defence of London must be secured by its armed citizens taking the initiative outside of London itself. That is the true defence of London, and let every man who has property and has the interests of the country at heart know that, if an enemy has landed on our shores, it is not behind walls that he is to defend hearth and home, but in the open country between London and the sea. That is to my mind the only practical solution of this question, and I believe in my heart it is the safest. I think it my duty, as Chairman, not to pass by without notice a remark which fell from a distinguished Officer, whose opinion upon a matter of this kind carries great weight. From the position which I have held in the public service under various Ministers of the day, whether of one party or the other, I do not think, and I am quite certain those who have had experience of the matter will agree with me, that the Ministers of the day have been wholly neglectful of this question, nor do I think that the administration either of naval or military matters is in any way to be improved by the suggestion which Sir Charles Nugent threw out the other day. In a Constitution like ours there are an enormous number of anomalies. The administration of the Navy by a Board, and the administration of the Army by a single individual, appears at first sight to show that there is an organic difference between them. Practically there is none. The Chief Minister of the Army is really responsible just in the same way as the First Lord of the Admiralty, and although we call the professional Officers who assist the First Lord of the Admiralty by the name of a Board, there is very much the same thing at the War Office, where the Secretary of State for War is surrounded by his own staff of professional Officers, who can, and do, advise him just in the same way as the Admiralty Board advises the First Lord, so that there really is no practical difference between one system and the other. The responsibility rests with the chief. It has also been said that the organization and administration of the Army and Navy in this country is not what it ought to be. No doubt to those who wish to have a theoretically perfect system there are certain inconsistencies in the matter; but, whilst I perfectly agree that we should have everything as far as possible thought out and fairly organized at the very commencement, I should be very sorry to see eliminated from the English character and the English system any particle of that thorough self-reliance of individuals which, after all, is the outcome of what appears to many people, and especially to

our friends on the Continent, rather a system without a principle. Remember that in the case of some of our neighbours who theorize to a very great extent, and who have their systems apparently in a very perfect state, if one little cog in the whole of their gear gets out of order their whole system is liable to break down. It is exactly the reverse with us. From the system upon which our Officers have been trained, our machine never is absolutely put out of order, and we always find, even if the system goes wrong, that the self-reliance of the English character immediately puts things to rights again. I should therefore deprecate having too much of the delicately organized system, which after all is the bottom of this paper, too much engrafted upon us, because, as Admiral Fremantle really did indicate, when we come to measures of that kind we are thinking more of ourselves than of other higher interests that we have in view. I beg your pardon for making this digression. While I have to a certain extent expressed my feelings not quite in sympathy with this paper, I do not the less appreciate the ability and talent of my young brother Officer in having prepared this paper, and I very cordially ask you to give him your thanks. There are many valuable thoughts in it, and with your permission I will convey to him the thanks of this meeting.

Friday, May 21, 1886.

ADMIRAL THE RT. HON. SIR A. COOPER KEY, G.C.B., F.R.S., &c.,
Vice-President, in the Chair.

THE DEFENCE OF THE COASTS OF ENGLAND, IRELAND,
AND SCOTLAND IN THE EVENT OF WAR.

By Rear-Admiral W. ARTHUR, C.B.¹

IN order that two small islands, with a population of less than forty millions, should possess Colonies and dependencies in all parts of the world, and make laws for the government of one-fifth of the population of the globe, it is necessary they should command special advantages over other nations beyond brute courage, and I believe that the inviolability of our country for so many centuries from foreign invasion and the control of the sea during war-time, which we have always maintained, are the leading causes of England's greatness, and should these causes cease to exist, we shall cease to be the banking and trading centre of the world, after which our accumulated riches will gradually dwindle away. These statements appear so self-evident, that it may be considered unnecessary to assert them, but incredible as it may appear, they are totally ignored.

That the defence of our coasts is intimately connected with the state of our Navy none can deny, as our land defences are not of themselves in a condition to repel invasion, for beyond the permanent fortifications intended for the protection of our dockyards and the military positions at Portland and Dover, some of which are not completed, we have no first class sea coast defences, and, neglecting the consideration of the inefficient forts at the entrances to our first class mercantile ports, our numerous harbours are open to an enemy's fleet, and there is nothing to prevent a hostile army landing on our shores, supposing they held the command of the Channel, and the invading fleet were supported by ironclads. If under such circumstances London were endangered, we could not purchase immunity for having neglected to take timely precautions for the defence of our capital under four hundred millions of money; two hundred millions and the cession of Alsace and Lorraine being the price France had to pay to free their land from the invaders.

Now the question whether our Navy is still as capable of defending our shores as it has hitherto been, you will, I think, agree with me in answering in the negative, for the enormous increase in the

¹ Read in Admiral Arthur's absence from illness by Rear-Admiral the Hon. Edmund R. Fremantle, C.B.

mercantile marine of late years, and our entire reliance thereon for food supplies, necessitates the protection by the Navy of extensive ocean routes, whilst from the increased expense of building those men-of-war we now possess, our Fleet is much reduced in numbers, besides so many nations now purchase or build powerful ironclads, that the forces liable to be arrayed against us have increased; likewise the motive power being now exclusively steam, coaling stations in all parts of the world are necessary, and as few of those now in existence are fortified, the Fleet must also defend them.

In 1882 a Royal Commission investigated the question of coast defence, but the necessary outlay was enormous, and the Report has virtually been ignored.

In the same manner an estimate was made for permanently defending our coaling stations sufficiently to relieve the Navy of a portion of that duty; it amounted, I believe, to upwards of eighty millions, not a large sum compared to the amount required to buy out the Irish landlords, but large compared with the amount the country is willing to give; in proof of this look at the eleven millions Lord Palmerston had so much trouble to obtain in order to build the Spithead and Portsmouth Hill Forts.

We will now consider what steps were deemed necessary for coast defence, at a time when we were at war, and when an attempt to invade our shores appeared imminent.

In 1798 an Order in Council was passed authorizing the formation of a force for that purpose, to be called "Sea Fencibles." It consisted in 1804 of some 24,000 men, 12,000 in Great Britain, and 12,000 in Ireland; the former force was under an Admiral, with 92 Captains in charge of divisions and subdivisions, and the latter under another Admiral, with 32 Captains; there were also from three to six Lieutenants in each district.

They appear to have been chiefly employed in manning the boats of the armed flotilla stationed around the coast. The pay of the men was one shilling a day when called out for drill or muster, and when on active service they received the pay of able seamen.

At that time there were 131 vessels in commission in the English and Irish Channels, and 153 in the Downs and North Sea, in addition to the harbour flotillas. Yet in the presence of this enormous force our coasts were again and again insulted, our booms at the entrance to the harbours were destroyed, and our shipping captured or burnt, so that everyone must agree with what the "Naval Chronicle" of 1810 says,—“Our merchantmen captured before our eyes, with the enemy's flag floating with gasconading insolence, is too much for an Englishman's reflection.”

The question now presents itself whether the introduction of steam has lessened or increased the danger, and whether long-range guns are more favourable to the invader than to the invaded. The answer to this must be conditional. Steam is especially favourable to desultory warfare, carried on by small vessels possessing great speed. A few hours only are necessary for a hostile ship to make a descent upon a mercantile port, commit a depredation, or levy a ransom, and then

retreat in safety if her speed be superior to that of the enemy's vessels; she would incur but little danger so long as her engines and boilers are in good condition. Her one long gun would enable her to bombard and strike a town with every discharge, whilst on the other hand the chance of hitting a moving vessel two miles off is small.

We will now consider the effect of steam on an organized invasion by a fleet of merchant steamers carrying troops, field batteries, horses, provisions, munitions of war, &c., and supported by an ironclad fleet. An invasion of this magnitude could not be undertaken with less than 75,000 troops, and would require 500¹ first class merchant ships as troopers to convey them and their impedimenta; we should therefore know beforehand of such an expedition being prepared, and should they give us the slip, it would take them a week to disembark, during which time, if we had not lost our naval preponderancy in the Channel, we could, by means of steam, collect our fleet and attack them. It is useless considering a case in which we were outnumbered by hostile ironclads in the Channel, for should such ever happen, there would be nothing for it but a land fight for existence within our own borders; so I think we may assume that steam is favourable to desultory attack, but opposed to organized invasions, except under circumstances in which naval opposition could not be attempted.

But the most important new element in coast defence and naval warfare has not as yet been referred to, that is, the submarine mine and the locomotive torpedo. In these, combined with the torpedo-boat, whether submarine, submerged, harbour, or sea-going type, all of which have their uses, we have a defensive power which, if organized and developed, will enable us to establish a system of coast defence that will entail but a small drain on the permanent forces of the country, whether Army or Navy; but it must be remembered that torpedo manipulation requires a long and careful training, and that no submarine mines are more efficient than those which are frequently laid down and taken up again.

Before entering into any details for defence by any combination of means now within our power, we must consider what the fleet of the future will be on which we must ultimately depend for the prevention of invasion, for all forms of defence are merely a means of delay, if the force necessary for the purpose can be brought to operate against it. England, notwithstanding her superiority in mercantile shipbuilding, has always taken the lead from France in designs for men-of-war. In the days of sailing vessels the best hulls were those copied from captured line-of-battle ships or frigates. Floating batteries and ironclads were first introduced by France, and they are now ahead of us in the coming arm, viz., the sea-going torpedo-boat. We now hear from France that the days of ironclads, of the present type, are numbered; and that such is really the case I feel perfectly certain, as the destructible ironclad, as I will call it, valued at half a million of money, can be sunk by a locomotive torpedo valued at 400*l.*, discharged from a sea-going torpedo-boat, valued, say, at 25,000*l.* Such an ironclad is unfit to go into action even if she

¹ See footnote on page 683.—Ed.

could be built with a speed equal to that of the torpedo-boat. The first and most natural suggestion would be that each ironclad should, for her own protection, have, say, four sea-going torpedo-boats attached to her to attack the torpedo-boats of the enemy, but even then she would not be safe; for in the smoke and confusion an erratic torpedo-boat might slip within range and cause her destruction. We are thus obliged to come to the conclusion that the ironclad of the future must be absolutely protected against torpedo attack; the torpedo net may be of some use for this purpose whilst a vessel is at anchor or steaming very slowly; but in a general action, when full speed is most desirable, it would be useless. Now, my personal opinion is that, ungainly and horrible as it will appear, we shall be obliged to throw out light, cellular scantling from each side of our vessels to a distance of not less than 12 feet, in order that we may have an air space between the point of explosion of the torpedo and the heavy plating. This will, of course, entail a great loss of speed, but speed will cease to be of such importance when the vessel represents an impregnable citadel, surrounded by a number of fast satellites. It is thus evident that a large increase in the number of our torpedo-boats is absolutely necessary, and that the Government must carry out, sooner or later, a series of experiments as to the protection of ironclads by means of air chambers surrounding the hull.

Now, to revert to coast defence: it appears probable that if the question is taken up seriously during peace-time, we may depend on volunteers for the purpose of protecting our smaller harbours and seaports from desultory warfare; of course the defence of such places as Liverpool, the Clyde, the Humber, Leith, Falmouth, Dublin, and Belfast must be entrusted to regulars, but one point should be clearly and definitely settled. Is the Government responsible for the protection of every point on the coast? They say no; they say they can only be responsible for such stations as are of national importance. The country says that every point must be defended, in proportion to its importance perhaps, but defended, and that the Government shall be responsible. Now it must be clearly borne in mind that an enemy has a right to harass your coast, and that the fact of a town being defenceless would not, under any circumstances, insure its immunity from attack. On the contrary, it would enable an attack to be made by a smaller force; in fact, I am sure you will agree with me that our coast requires a more complete system of defence than at present exists; why even the harbours of the United States are better protected than ours, and many of our Colonies are paying more attention to the subject than the mother country. The necessity for something being done during peace-time was never more completely demonstrated than when we awoke one morning in the past year and found ourselves on what appeared to be the brink of a great war, something very like a panic being the result. Several Defence Associations sprang into existence, each more or less being led away with the idea that torpedoes would do for us what we had neglected to do for ourselves, and keep the enemy from our coast. I grant you that there is some justification for such an idea, and the

defence obtained from torpedoes is comparatively an economical one, more especially if the personnel is provided for by voluntary efforts. There appears to be a growing opinion that but little difficulty would be found in raising local corps for this purpose. It must be remembered, however, that small seaports are not generally very rich, and many of them have but a small population. Likewise it should be borne in mind that their destruction, although entailing no national danger, would be a national insult, which we should all combine to prevent, if possible; so I think we may fairly come to the conclusion that torpedo volunteer corps, if raised, should be put to as little expense as possible and be assisted by voluntary subscriptions. The Government should likewise undertake to find the material of war, including locomotive torpedoes, spar torpedoes, gunboats, guard-boats, torpedo-boats, submarine mines, cables, long-range guns, mortars, and machine-guns; the submarine mines and guns would be supplied by the War Office, the Admiralty providing the other stores, thus distinguishing between the shore defence and what may be called the floating defence. The Naval Volunteer Home Defence Association contemplated raising sufficient funds to enable volunteer corps to possess their own boats and torpedoes, but a little consideration will show that it is not only desirable, but absolutely necessary, that they should be found by the Admiralty. This, I think, we may take for granted will, if done at all, be ultimately done by that department. We will now consider the question of personnel.

As with the stores so with the personnel, separate corps will be necessary. First, a naval volunteer force to man and fight the guard-boats, gunboats, and torpedo-boats, and to manipulate the locomotive and spar torpedo. Second, a military volunteer force to obstruct the Channel with mechanical and electrical mines and to man the machine-guns in position, the guns of shore batteries and mortars.

As regards the naval element, the most readily available and efficient force would be the Coast-guard; but it has been distinctly laid down that on the outbreak of hostilities these men, being most efficient seamen and seamen gunners, would be required for our sea-going fleet. I think, however, that we are neglecting a great source of strength in not taking steps to replace the Coast-guardsmen at the shore stations when they are embarked. There was provision made for this in the original scheme for the organization of the force; it was even contemplated that their places should be filled up when embarked for annual exercise; the only objections to this are as follows:—

First, the men leave their wives and families in their cottages when they embark, consequently the cottages are not available for the temporary hands. Second, the expense of replacing the men for a short period, during which they could be dispensed with. As regards the first objection it would be desirable and necessary, should the men be permanently embarked in time of war, to give the wives of the men afloat a boarding allowance, they could then live with their own families, and the Coast-guard houses be available for others.

Second, in war-time retired Coast-guardsmen or seamen pensioners could be obtained for a small sum of money, and as far as possible men belonging to the naval volunteer force should be taken on. It is not absolutely necessary that these men should be employed when the Coast-guardsmen embark for their six weeks' drill at sea. As an experiment it would be desirable occasionally, but their immediate enrolment and occasional muster cannot be neglected if the coast-guard organization is to be maintained during war. I may here mention that we neglect a great element of coast defence and a means of saving life in case of shipwreck, by not connecting the whole of our Coast-guard stations by telephones, or joining them up with the general telegraph system, in which case they could communicate with passing vessels, and would I believe be self-supporting if worked by the Coast-guardsmen's wives or daughters, who would soon become quite competent to undertake the work. I could give many more reasons why we should maintain the Coast-guard organization perfect in case of war, but the necessity is self-evident, and one can only be astonished why no steps are taken for the purpose. The Coast-guard should provide instructors for the coast volunteers to take charge of locomotive and spar torpedoes, torpedo-boats, guard-boats, and all naval stores.

In addition to the Coast-guard we have a volunteer corps that has hitherto been somewhat isolated, but which if associated with the Coast-guard for coast defence would soon become a valuable addition to our volunteer force; it is called the "Royal Naval Artillery Volunteers," a name that does not clearly convey either the work they have hitherto performed, or that which they would have to undertake if they co-operated with the Coast-guard in the duties enumerated as pertaining to the naval volunteer force for coast defence. Should this force be reconstructed so as to undertake the duties relating to coast defence, they would have to recruit more from the seafaring and fishing population than hitherto, the majority of them at present being men of some means and many of good position in society.

Hitherto they have been instructed in the use of great gun, cutlass, and rifle, they drill frequently in a gun battery on shore having naval fittings, and they embark in a gunboat about once a year for exercise afloat, when they show great zeal in undertaking even the menial duties of the vessel; but if they recruited more from the fishermen class, and were as proposed closely allied to the Submarine Mining Volunteers, it would be necessary for them to receive the 5*l.* capitation grant which is given these volunteers in view of their extra drills, longer hours, wear and tear of clothing, &c.

As regards the present state of the Royal Naval Artillery Volunteers, I cannot do better than to quote and adopt the description made respecting it in an article on Coast Defence, to be found in the "Admiralty and Horse Guards Gazette" of the 2nd May, 1885.

"It is now just twelve years since the Admiralty decided to form the present three brigades, which are limited to London, Liverpool, and Bristol, with batteries at Brighton, Hastings, Southport, Birkenhead, Bangor, Carnarvon, and Swansea. In spite of the Government

having hitherto failed to recognise their status (by the withholding of a capitation grant), these brigades are in a most efficient condition, and repeated applications have been made from other quarters for an extension of the movement. It was hoped when Sir Thomas Brassey took office that the Admiralty would see their way to acceding to these requests, and to organizing the force on a more permanent basis; but probably, owing to the slight additional expense that would be entailed by the grant of a capitation allowance, which has been recognized as necessary for the efficient maintenance of the force, no steps have hitherto been taken to tap this promising source for adding to the defensive strength of the country. If, however, as we suppose, the services of the Royal Navy and of the Royal Naval Reserve are required for other purposes than the defence of our coasts, now would appear to be the proper time for urging the claims of the Royal Naval Artillery Volunteers to take up their recognized place in the defence of our mercantile harbours and seaports. Every port in the kingdom should be invited to raise a battery of sixty to eighty men for local defence. Each battery should have attached to it a retired Officer of the Navy. The men should be supplied with boats, and those knowing intimately the channels and coast in the neighbourhood should be used to man torpedo-boats. We feel sure that were such an invitation issued, it would meet with a hearty response, and that large numbers of our fishing population would readily join the force, providing a capitation grant was allowed to defray incidental expenses. It might, perhaps, be necessary to give a slight increase of retired pay to naval Officers who joined the force, or better still, to allow time served with the batteries to count in a certain proportion towards increase of pension on final retirement. Half-pay Officers of Commander's rank or Gunnery Lieutenants should be selected by the Admiralty to command districts of ten or twelve batteries. The functions of the force would be two-fold—land defence and sea defence. The first would consist in the defence of coast batteries mounting naval guns; the battery to be masked if possible, and with as near an approach to all-round fire as practicable. The men should be trained in the rifle and cutlass exercises as taught in the Royal Navy. The sections for sea defence would be specially trained in the system of torpedo warfare from shore or boat, and would form the *élite* of the local force, consisting only of men thoroughly acquainted with the coast and with the set of the tides in the neighbourhood of the port. Steam launches should be attached to the various harbours for their use, a chief stoker, or engine-room artificer, from the Navy, being charged to look after the engines. An instructing Officer, occupying the position now held by Adjutants in the Rifle Volunteers, should be placed over a number of districts. His duty it should be to go round and inspect the various batteries from time to time, and to report on each occasion to the Admiral Superintendent of Naval Reserves. Under him, retired gunners should act as instructors. In order to recruit such a force a capitation grant is an absolute necessity; probably 30s. for all men qualified to take part in land defence, and a somewhat higher rate, say 50s., for those efficiently trained for sea defence, the wear

and tear of clothing being greater in their case, would be sufficient. The extension of the Naval Artillery Volunteers would offer a good opportunity for utilizing the previous training of naval Officers on retirement. At present the expensive training of Officers is practically lost to the country as soon as from age, or from private reasons, they quit the Service, and after a few years of vegetation they become unfitted for employment through having lost touch of the Service and of the improvements made in naval warfare. If, however, Officers of known efficiency were invited on retirement to accept appointments in the Naval Artillery Volunteers, we feel sure that many of them would be willing to serve their country in such a capacity."

We will now consider the organization of the military volunteer force for the purpose of coast defence. Of course, wherever there are War Office stores there must be a small permanent staff to take charge of them, these men would thus also be available for organizing and instructing the necessary volunteer corps. Several ports have already started such a corps under the name of Trained Volunteer Submarine Miners; they have been assisted by the Government by having instruction imparted to them, by having their stores given them, and by a 5*l.* capitation grant. I think we may assume that what has been done is only an indication of the facility with which the movement may be extended. It would now be desirable to consider how far the Government would be willing to adopt the suggestions now made, and I am afraid we are bound to come to the conclusion that unless public opinion is asserted in a more decided manner than appears likely at present, coast defence will not be taken up in earnest. Whenever a war scare is started, spasmodic efforts are made for the time and then die out. During the scare of 1885 two organizations—"the Empire Defence League" and "the Naval Volunteer Home Defence Association"—sprang into existence, the latter being an amalgamation of two others then started, and the former being designed to bring moral influence to bear on the subject. The Naval Volunteer Home Defence Association attempted to collect funds from the country in general in order to assist the seaports in raising the necessary material for coast defence without appealing to the Government, and to assist in providing funds for raising the necessary volunteer corps. Both of these associations have failed, the Government has resisted the moral suasion, and public opinion appears to be decidedly adverse to any attempt to raise the necessary funds for torpedo-boats, &c., by public subscription, whilst, on the other hand, the Government distinctly state that they can only be held responsible for the security of those large centres of trade, the destruction of which would be attended with serious consequences to the nation in general. In answer to a question put in the House of Lords in July last, the Earl of Harrowby, in a spirited speech in which the importance of the subject was acknowledged, stated, "The naval requirements for such defence were two—material and men. Ships, of course, were wanted, torpedo-boats and everything connected with them, also steam-tugs of sufficient speed to be used as gunboats. The present opinion of the Admiralty after taking the best advice was, that they ought to

rely upon support other than that of the Government, and he hoped that the localities and patriotic associations would be able to supply material for the movement."

Now, everyone acquainted with the cost of the articles enumerated amongst the necessary material would see the impossibility of raising sufficient funds by voluntary efforts. The following list of places are already more or less defended, and may be considered of first class importance; for these the Executive Government should be entirely responsible, and their defences should be completed without loss of time; their torpedoes, cables, &c., should be stored on the spot, and be occasionally laid down for exercise.

Military ports—Portland and Dover Dockyards, Portsmouth, Plymouth, Pembroke, Cork, Sheerness, and Chatham.

Commercial ports of first class importance—London, Liverpool, Holyhead, the Humber, Clyde, Southampton, the Forth, the Tyne, the Tees, Bristol, Swansea, Dublin, Belfast, Sunderland, Folkestone, New-haven.

This list alone must remind many of my hearers how much requires to be done to defend our coast. Fortunately our principal commercial ports are situated upon navigable rivers well adapted for defence by ground mines and torpedoes. London is well up the Thames, Glasgow up the Clyde, Newcastle up the Tyne, and Liverpool up the Mersey; they can, therefore, be made absolutely safe from naval attack by sealing the mouth of the river.

The ports of secondary importance which might be entrusted to volunteers are—Harwich, Yarmouth, Lowestoft, the Tay, Aberdeen, Wick, Thurso, Ramsgate, Rye, Littlehampton, Poole, Dartmouth, Barnstaple and Bideford Bay, Wexford, Waterford, Kinsale, Galway, as well as many wealthy open watering places. The question now remaining for solution is the modifications required for the defence of ports by reason of the introduction of ironclads, heavy guns, electrical and ground mines, torpedoes and torpedo-boats. Against ironclads and heavy guns there is nothing more efficient than mortars, they penetrate all decks of an ironclad, and pass out through her bottom. It is frequently believed that they would never hit a moving object on account of their trajectory being at so high an angle, but when the distance is accurately known, as in a narrow channel, and the powder is trustworthy—as is not always the case—there is but little deviation from the spot the projectile should fall on; besides it must be remembered that even rifled mortars are comparatively cheap, the sunk batteries they are fired from are easily and rapidly constructed, and at least twelve mortars could be mounted in the space occupied by two heavy guns. In those mortar batteries I have seen designed, the battery could be rapidly cleared of men by means of tunnels and chambers built in the earthwork, and the mortars fired in a bouquet by observations taken from a favourable position. Mortar batteries, of course, would only be required for first class ports likely to be attacked by ironclads. They may, however, be considered a modern form of defence when used against a naval attack, but they are thought very highly of in the United States. Some very perfect mortar

batteries have been constructed for the defence of Boston, U. S. A., and other ports. But even with mortar batteries the ironclads would have forced their way wherever there was water enough for them to float, had it not been for the development of torpedoes. Now I would not have you exaggerate the importance of torpedoes, they require very favourable circumstances to be impregnable; for instance, if they are not protected by machine-guns and torpedo-boats they are simply an impediment that will delay the advance of the enemy by a few hours, who would only have been put to the expense and delay of countermining. We may, therefore, assume that whenever ground mines are used, torpedo-boats, machine-guns, either mounted on shore or in guard-boats, are necessary. A heavy gun in position having a long range would also be desirable even in ports of secondary importance.

Having made these preliminary remarks, I will proceed to state briefly the minimum amount of preparation necessary to form the basis for the development of the defence of our first and second class commercial ports in case of war, without touching on the question of defence of military ports and dockyards.

Our first class commercial ports are, as I have before stated, generally situated some distance up a navigable river, and are consequently easily defended from naval attack by a combination of electrical and mechanical ground mines and torpedoes, supposing vessels of sufficiently light draft for countermining are not allowed to approach the defended position. I say nothing of the approach of ironclads, so long as the torpedo field is intact, as I consider we may ignore any attempt at countermining being made by such a valuable weapon, the submarine mines would be defended when practicable by heavy guns and machine-guns mounted on shore, and by guard-boats and torpedo-boats afloat. Much, however, has already been done and is being done for the defence of first class commercial ports.

As regards the number of guns mounted on shore, two might be considered sufficient if they covered the whole of the torpedo ground. If it were not for the expense, forts built in the water near the main channel would be in the best situation for defending submarine mines and utilizing electrically steered and locomotive torpedoes.

There are good specimens of these in the circular forts at Spithead, and in the more elaborate and expensive structure being erected for defending the narrow approach to the town of Baltimore, U. S. A. In both of these cases the forts are protected by iron plates, and may be made practically impregnable against horizontal fire, as there is no limit to the thickness of iron such a fort can be made to carry—I say “made to carry” advisedly, as they have not hitherto invariably succeeded in carrying their armour; one of the Spithead forts having been abandoned from the foundation giving way, and about 40 yards of the fort at Baltimore having to be reconstructed for the same reason. This, however, is merely a question of construction, and I would suggest smaller forts, with a concrete base twice as large as the foundation of the fort.

Any fort, however, built in the water must be expensive, and where

a projecting point of land is available, a two-gun earthwork of sufficient strength to resist the fire of the guns of any vessel likely to be used for the purpose of attacking such a position would be cheaper and nearly as effective: remarking, that in some of the American earthworks designed for this purpose, a thickness of parapet of not less than 60 feet is deemed necessary, and the guns are mounted on disappearing platforms, a form of fire coming rapidly into favour in England.

I would now try to impress on my hearers the advisability of constructing torpedo-boats capable of almost total submersion, having a cupola of only 4 or 5 feet in diameter exposed to the fire of the enemy when at deep draft, the cupola having sufficient thickness of metal to neglect the fire of machine-guns; the light draft speed should not be less than 20 knots, the deep draft speed would probably be about 14 knots, at which rate, with her small exposed surface, she might risk the fire of the heavy guns of the enemy. Such a boat would be armed with a Whitehead torpedo discharged through the point of the bow, or else with an Ericson torpedo of small diameter, discharged from the same position, and capable of penetrating a torpedo-net. This boat might discharge its projectile at a distance of not less than 20 yards from the enemy, without being involved in the effects of the explosion. This I may add would not be the case if she were a submarine boat, immersed even 5 feet below the surface. For some purposes, however, the power of total submersion, as with the Nordenfelt boat, would have its advantages, such, for instance, as her capability of firing under the net, a power she would have to exercise with considerable caution and at no slight distance off, otherwise she would be included in the area of explosion, as has hitherto been the case when submarine boats have succeeded in the destruction of their opponents.

Another drawback to submarine boats is the impossibility of seeing the enemy when under water, and the difficulty, under similar circumstances, of steering a compass course with sufficient accuracy to ensure finding her, if the object should be to attach a delayed-action torpedo and retire. I have no doubt whatever that our gallant Torpedoists will think nothing of these objections, and may shortly succeed in developing on the lines mentioned, or in some other form, the usefulness of this plan of attack.

As regards the guard-boats for the defence of submarine mines, it would be very desirable if life-boats could be constructed to carry machine-guns, in order that they might be utilized for this purpose. Of course this would necessitate propulsion by steam; and that steam life-boats have not already been generally adopted seems to many a mistake. For instance, where tugs are available they are used to assist the life-boat in getting to windward of the wreck she is required to assist. An objection might be raised as to delay in getting up steam, but with coil boilers such as the Herreschoff 48-foot steam pinnaces, which I sent from America five years since, steam could be raised in five minutes. The engine-rooms and cabins are hermetically sealed fore and aft, with the exception of a 10-foot well abaft, the deck of

which is above the water-line, having self-clearing valves as in the ordinary life-boat, there is a forced draught of air into the engine-room, the pressure being maintained about two pounds above the atmosphere. The only objection to this class of boat has been the small amount of water contained in the coil tubes, and this defect has lately been overcome. Such a boat requiring stokers and skilled labour would have to be manned by the Coast-guard, but they already man many life-boats, more especially when they are launched for active service.

The number of the torpedo-boats to be supplied by the Admiralty need not at first be very great, as they would only be required for drill purposes, and could, as is the case now with the gunboats used for embarking Royal Naval Artillery Volunteers, be passed from station to station for that duty, the Officer in command and small staff being retained.

Before concluding I would draw your attention to the small extent to which our mercantile marine contributes towards our national defence, and which I am sure must be deplored by every true lover of his country. Considering the reserve of 80,000 possessed by the French, we might fairly ask for a first and second class Naval Reserve of 40,000 men, a proportion of whom might be raised in the Colonies and drilled on board our men-of-war.

The comparatively small number of seamen now entered in our Naval Reserve is due to the large proportion of foreign seamen who man the merchant vessels now sailing under the British flag. The true mercantile British sailor who up to thirty years since took so large a part in the manning our ships of war still exists in reduced numbers, and as such has come forward readily to form our existing Naval Reserve: the fact that there are not more reserve men is simply because there are no more of the same stamp to enlist. We might fairly refuse to grant any vessel the use of the British flag unless the majority of her seamen were British subjects. It may be argued that freight is now so low that vessels could not afford to run at all if they had to pay the high wages demanded by British seamen; it must be remembered, however, that the reserve men are to a certain extent subsidized and provided for in their old age, consequently are eagerly sought after. The number of British seamen and of reserve men could be readily increased by giving a certain proportion of the boys educated in our training ships, on attaining the age of nineteen, the option of leaving the Navy and joining the Naval Reserve for ten years, instead of as at present serving the same time in a man-of-war. Of course a proportional increase would have to be made in the number of boys entered in our training ships. This is, however, a question more affecting the reserve of our fleet than actual coast defence, but some now present may remember the efforts made previous to the Crimean War by a small but earnest body of our fellow countrymen to point out what was palpable to every seaport labourer, that, whilst we had sufficient ships to quadruple our fleet, we had no seamen to man them.

The Crimean War exposed the calamitous position our Navy had

drifted into. In those days a British fleet had to be sent to sea with three-quarters of their crew consisting of landsmen who had never been to sea before, combined with a small proportion of the scum of Tower Hill who generally deserted; the small body of seamen gunners (thirty) and the marines alone rendered such an attempt possible.

Fortunately in those days the French were our allies, and we had only the Russian fleet against us. This led to the question of manning our fleet being seriously taken in hand, and right well did the Admiralty deal with it. The continuous service was established and all men-of-war seamen now enter for 10 years instead of 3. Boys are entered at the age of 14½ and trained, so that at the age of 19 years, when they commence their 10 years' servitude, they are better instructed in their gunnery drill than an able seaman used to be when the ship had been one year in commission, and possess nearly as good physique. Men now get their pension sooner, generally before being 40 years of age, and consequently are available for Pensioners' Reserve.

The Coast-guard that was previously under the Board of Trade, and contained but few men of any use in a man-of-war, was transferred to the Admiralty, and now consists of the pick of the fleet; these men are available for embarkation within forty-eight hours. The select of the merchant service likewise form an additional reserve of men who, besides being seamen, have an annual training in gunnery and small arms. We have also that fine body of men the Marines, who combine in an eminent degree efficiency and economy. All these have tended to produce, within the last thirty years, a comparatively satisfactory result as regards our capability of manning our men-of-war in case of emergency. But, on the other hand, it must be remembered that during the same period, in spite of the additional expenditure entailed by the general adoption of steam and the necessary machinery; of the introduction of iron instead of wood for the hull, and the fitting of thick iron plates to the sides; of a more complicated and expensive armament, necessitating carriages that are of themselves an effort of art; of the introduction of torpedoes, electric light, &c., yet the country has consistently adopted a policy of attempting to reconstruct our Navy on the ordinary estimates, with a result that, even after one or two spasmodic efforts to augment our fleet,—resulting from scares, which caused a great waste of money,—we should, if war broke out to-morrow, find ourselves with a reserve of ships and torpedo-boats unequal to the requirements of the fleet alone, and consequently with none available for coast defence. I therefore advocate strongly an extension of our Volunteer movement for this purpose, feeling certain that if the Government will supply small detachments of Royal Engineers, consent to our Coast-guardsmen being replaced as fast as they are embarked, and supply the necessary stores, the patriotism that, contrary to the opinion of all Europe, carried our military Volunteer system through, will also make our Volunteer Coast Defence a success.

The calculation of 500 first class merchant ships, on page 673, is based on the number of merchant vessels permanently employed for the conveyance of the army

which captured Pekin in 1859—after the landing of the troops, horses, artillery, &c.; they were anchored off the Taku Forts, having on board, besides three months' provisions, stores and ammunition, thus forming a base of operation for the army. The possibility of landing 75,000 men without provisions and reserve of stores was never contemplated. (30th June, 1886.)—W.A.

Captain W. F. S. MANN, R.N.: The paper we have just heard, following those of Major Elsdale on the "Defence of London," brings before us the whole question of the defence of the country from various points of view in case of war or invasion. A naval man speaking on this subject cannot be accused of saying "there is nothing like leather," as it is an undisputed fact that the Navy is our first line of defence. I am one of many who believe that this object, namely, the defence of the country, can best be obtained by keeping our Navy at such a strength as to be always ready to take the offensive—for I hold that our tactics should always be offensive—in any probable combination against us, having as its base fortified ports and properly organized coast defence. If these two offensive lines of defence, if I may say so, are strong, not a man should ever be able to land on our coasts. The two points that seem to me to be of the greatest importance in the consideration of this paper are, first, Is the Navy still as capable of defending our shores as it has hitherto been? and secondly, Has steam given the invader or the defender the most advantage? Admiral Arthur answers the first question in the negative. If that be the case let us make it so. All the money that can be got out of the Treasury, and our Chairman probably knows better than anybody else how difficult it is to get it, should be spent in this direction. What is the good of having a first line of defence not really strong—merely a make-believe? Our naval defensive strength should be beyond question; these are the words of the Chairman in a letter that he wrote to yesterday's "Times," and everybody knows they are true. In answer to the second question Admiral Arthur says, "We may assume that steam is favourable to desultory attack but opposed to organized invasion, except under circumstances in which naval opposition could not be attempted." I suppose we must all agree in that; it seems to be unanimously the opinion that an invasion could not be attempted unless the enemy had command of the sea for a considerable period. I know there are people who believe that owing to most extraordinary complications conditions would arise which would make that probable; so we should be prepared for that, but, on the other hand, we should beware of going to the other extreme. I cannot imagine that this country could be left entirely without any naval force. I do not think it is an absurd simile to ask, "Would a man who owns a London house if he were going to the sea-side dismiss his servants and leave the whole of his windows and doors open?" But supposing all the ships, including coast defence vessels, gunboats, torpedo-boats, &c., were absent, this is where steam would come in to our advantage, it would be quite impossible for the enemy to collect vessels to contain a force even 75,000 strong without our being aware of it (I understand that the military authorities consider that invasion would not be attempted with less than 150,000). Admiral Arthur says that 500 first-class merchant ships would be required to carry 75,000 troops. I venture to doubt that; we know what number of ships was required to take 16,000 men to Egypt, and that was for a long sea voyage; of course for a short sea voyage at least double the number could be carried by each ship. These transports would have to be prepared for reception of troops, horses, pontoons, &c., which would take a good deal of time. I think, therefore, there would be ample time for us to recall our forces if they were scattered. Imagine what a few "Hotspurs," "Polyphemuses," torpedo and gunboats would be able to do amongst a great mob of merchant steam-ships full of sea-sick soldiers. Still, we ought to be prepared for all emergencies, so I should vote for the protection of the country on the lines I have laid down, which, if carried out, would prevent panics, also that waste of public money when they periodically occur.¹

¹ What occurred in the past when wind was the only motive power could not happen in the present, steam and electricity have entirely altered the conditions, making them more favourable for the defender in case of attack on our coasts or invasion.

Captain Sir ROBERT MOLYNEUX, A.D.C., K.C.B., R.N.: I wish, Sir Astley Cooper, to offer a few remarks upon this paper. I am sure that we are very sorry that Admiral Arthur is not able to read it himself, but I think that if it be successful in reawakening an interest in this very important question it will have done very good service to the country. I will first allude to the point in the lecture on the subject of the Naval Volunteers. I see there are one or two Officers here who are very much better qualified to speak about them than I am, and therefore my remarks will be few. My experience of them is that they want reorganization. Of course they would be very glad to have a larger capitation grant, but they must first show that the reorganized force can take a distinct part in the national defence, they will then thoroughly deserve an increased capitation grant, and I hope they will get it. No doubt in time they will. In these days seamen alone are not of the slightest use on our torpedo-boats, guard-ships, &c. You require men qualified to fill a great many other departments, and Volunteers must see the necessity of taking steps to include in their ranks men qualified to fill all those departments required on board ship. When they have done that they will be able to hold a very important part in the defence of the country, and will deserve every encouragement. But there is an encouragement that they want, and which they can have quite independent of money—they want a little more recognition. There are many opportunities in which I think the Naval Artillery Volunteers could be more associated with the Navy, for instance, at the experiments last year at Bantry Bay, or at those contemplated this year at Milford Haven, a very good opportunity would be offered by such operations for the Volunteers to perform duties in every respect exactly similar to those of our seamen. I do not suppose for a moment they would expect to become the rivals of our seamen, but it would give them instruction, it would bring them into notice, and the harder you work them, the more they like it. I am quite certain that it would have more effect than even an increased capitation grant. There is another point, a very important one, but it is perhaps rather beyond the limits of the paper, namely, the question of Officers. This question of training Officers for the reserves is a very difficult one, especially with reference to Volunteers. I do not think myself that the retired naval Officers, although they would contribute towards it, would, as suggested in the paper, be able to supply the want. In the first place there are not enough of them who have been recently employed in the Service, and, as a rule, when they retire they naturally have risen rather towards the higher ranks. You want a lot of young active men prepared to do a good deal of hard and yet responsible work. The retired Commanders and Officers of higher rank would hardly care about this, and therefore it becomes a very important and difficult question, but one which at the same time should be thought out and faced—how we are to train Officers to man all these gunboats and torpedo-boats?—because the Royal Navy would not be able to supply them without making great sacrifices in other directions. Whether true or not that the days of ironclads are passing away, there will certainly be large numbers of gunboats and torpedo-boats employed in any future war, when the number of highly trained Officers, and also of highly trained men, that will be required will be very much larger in proportion to what it is at present; that is a thing that ought to be taken into consideration at once. You cannot make a gunboat commander, or a torpedo-boat commander, or even a torpedo-boat stoker, in a day, and whether it be the Volunteers, the merchant seamen, or the fishermen class that are to supply this want, they ought to be found at once and trained without regard to expense.

Lieutenant-Commander C. E. SETH-SMITH, Royal Naval Artillery Volunteers: I should not venture to address this meeting, comprising as it does distinguished Officers of both Services, among whom I see several who have given special attention to this subject, but for the fact that in Admiral Arthur's paper there is frequent reference made to the Naval Volunteers, whose position he very courteously described as having hitherto been *somewhat isolated*. He points out, as has been pointed out frequently in this Institution and elsewhere, and by no one more clearly than yourself, Sir, that England cannot expect the Royal Navy to undertake the defence of commercial ports. It is a recognized thing, I think, that no invasion need be feared except after some such disaster as Captain Mann seems to think is almost impossible, but accidents happen even in the best regulated of Her Majesty's ships, and it is possible

we know that such an accident may happen to our Fleet and Army as may involve the deplorable necessity of calling upon the Volunteer Reserves of the country to defend their shores. Admiral Arthur speaks, and so does Sir Robert Molyneux, of the want of encouragement from which Naval Volunteers have suffered in past years, but when we consider how many years and how much perseverance it took before the Army Volunteers attained their present recognized position, I do not think it is altogether unnatural to expect that the Naval Volunteers must also go through a long time of probation. One great reason, perhaps, why this encouragement has not been given so freely as the Volunteers would have liked, is the fact that hitherto, in all your schemes of coast defence, the Admiralty, I understand, have failed to see in what way the Naval Volunteers could be utilized, and of course, if you cannot see how to utilize the force, it is difficult to give that force encouragement. But I do think the thanks of the supporters of the Naval Volunteer movement throughout the country are due to Admiral Arthur for so clearly pointing out that there is some part, and a not dishonourable part, that the Naval Volunteers can take in the defence of the country, whether it be relieving the Coast-guard or manning the guard-ships and torpedo-boats, or even in assisting the new submarine mining engineers. When Admiral Hamilton, who during the war scare was appointed more particularly to inquire into the position and resources of the Naval Volunteers, did me the honour of allowing me to assist him, I was able to assure him that the Naval Volunteers were willing to place themselves unreservedly in his hands, or in the hands of anyone appointed by the Admiralty; that they were willing to undergo any instruction he should think fit to give them; and that they had no desire to dictate any terms whatever. The feeling of the Naval Volunteers throughout the country is to try and be of some use, and of course they must leave it to the higher authorities to say in what way they can be employed. If they will only tell them that and show them how they can get the needful instruction, the Naval Volunteers are only too anxious to learn anything that may be thought fit to learn. I have also endeavoured so to assure Sir Robert Molyneux, who is continuing the work commenced by Admiral Hamilton, and I am very much obliged to him for saying in this Institution, that he is aware of the fact that the only kind of encouragement the Volunteers want is to be recognized as being willing to try and do what work lies in their power, and as he says, "the harder you work them the better they like it." Admiral Arthur calls attention in his paper to this point, that the Government say they are not responsible for the defence of every point upon the coast, but only for certain important stations. With reference to that he adds, "The country says that every point must be defended, in proportion to its importance, perhaps, but defended, and that the Government shall be responsible." If I read the signs of the times aright, I think the country says more than that; it says every place must be defended, and it says that these places are willing to defend themselves so far as in them lies. It is well known by a great many members here present, that from nearly all our seaports and towns round the coast offers of service from men as Naval Volunteers have been forwarded to the proper authorities. I think that is a clear proof the country is no longer apathetic on this point. Of course one understands there must be some delay in saying either yes or no to such offers, but it should be clearly understood, certainly in this Institution and by the regular Services, that there are those who have not the honour of belonging to either of the regular Services, yet still are Englishmen, and anxious to do what in them lies to serve their country, and that there are those on the coast willing to place the special knowledge they possess in the way of local pilotage and experience gained, either in the exercise of their calling or in pursuit of nautical pastimes, entirely at the disposal of the Admiralty, provided only that "my Lords" at the Admiralty will take them up and place themselves at the head of the movement, as a Naval Volunteer force, but the *naval* element must be distinctly recognized, as far as it goes. I think when this paper is published, the Naval Volunteers everywhere will feel really grateful to Admiral Arthur for pointing out so clearly that at any rate in his scheme for coast defence, "Naval Volunteers" have a place.

Captain CURTIS: This is rather an old tale, the defence of our shores, and a great many of the gallant Officers here will recollect how in 1858 or 1859 there was a great scare, and the Royal Naval Coast Volunteers were then formed. Having been

First Lieutenant of the Coast-guard ship at Liverpool, I had a very good opportunity of judging of the men who were then enlisted, and really if half the men had been kept instead of disbanded, they would have been a very efficient force for those times. They were Manx men, fishermen and coast fishermen. The force was got together in too much haste, and many of the men, I consider, were over the desirable age, say twenty-five years. But, as far as my experience goes, I decidedly object to enlisting men more than twenty-one or twenty-two years of age. Fisher lads, barge lads, and long-shore lads from sixteen to seventeen, should be encouraged. I think there should be two classes, a first and second class, and a boy and man class, and they should pass from the boy into the man class at nineteen years of age, if qualified. I have been at Yarmouth, where there is a large Institution where they board the fisher lads when they are not out at sea, and where there are some 200 or 300 lads.¹ You could get the whole of those lads, I should imagine, in a reserve force, *graft them into the Navy*, as it were. When you get hold of a man over twenty-one, his ideas are formed, and it is very difficult to get out of his head what he has got in it. I say those, the young lads, are pliable, and the proper class to recruit from, and I think in the course of ten years, if the Government will look up these lads, they will have a very efficient force. With respect to the foreign fleets, what they will do will be to destroy our commerce, our most vulnerable point. They will not come to Spithead, though they might fire a shot at Brighton if they found a ship was not there. Admiral Arthur seems to suggest that we are to send a ship afloat in a dry dock, that is to say, we are to have air tubes round her, and those air tubes must be 12 feet from the real ship. By what authority he suggests such an affair I know not. It appears to me, from the little I understand of the subject, that Sir Edward Reed is much nearer the point, that is, by having corrugated tubes to contain water, round and under the ship, fitted with some slight air escape.² With reference to the Coast-guard, they are very efficient men, and really to be depended upon, and so were the old naval trained Coast-guard men. I know that when we commissioned in the "Royal Albert," in May, 1854, there were Royal Artillery men who turned some of our rigging in. We could not get to sea till October, and we had to get the Coast-guard men from the Baltic Fleet when they came home for the winter. The real point after all is that the money expended on the Navy is only an insurance on our commerce. The cost of the Navy should be 15 millions a year, or only $1\frac{1}{2}$ per cent. on our 1,000 millions of commerce. The Army costs $16\frac{1}{2}$ millions. Everybody acknowledges that the Navy is the right arm of the country. It is well known amongst naval men, 11 millions is not sufficient to keep up an efficient Navy for the duty it has to perform; the Service has been starved for years. Why then begrudge the money? It is only an insurance on our commerce, and a very small one too.³

Professor LAUGHTON: There are one or two points in Admiral Arthur's paper to which, with your permission, I should like to call attention. And firstly, as to what Captain Mann has said⁴ about the proper means of coast defence being such

¹ At Hull and Great Grimsby there are no doubt many young fisher lads that would join a reserve force, "if adequately remunerated."

² These tubes could, if required, be pumped clear of the water in them.

³ I beg respectfully to recommend to Naval Officers the "Study of Fluids," by Stanley, published by E. and F. Spon. It is a work that should be in every first-class ship's library. I venture to assert, if this book had been studied, the costly mistakes of ships steering badly, and the erratic behaviour of torpedoes, would have been remedied sooner, or possibly would not have occurred.

⁴ After the meeting Captain Mann told me that I had misunderstood him; that he had not meant in any way to deprecate measures for coast defence, but only to urge that it should be subordinated to a powerful seagoing force; that the first element of defence should be the command of the sea. With that I fully agree; but the instance I have given—which is only one of many—shows that, however strong the fleet may be, an active enemy may evade it, and find some unguarded place.—J. K. L.

an increase of our seagoing Navy as would wipe the enemy off the sea. In considering a question of this kind it is always well to look back to what has been done in years gone by; because we may fairly suppose that what has been may, under similar circumstances, again be. From this point of view the teaching of the past is this, that in the whole course of our history at no time has the superiority of our Navy over that of the enemy been more manifest than in 1760, when Hawke and Boscawen had completely crushed the French Navy; when our ships cruized unmolested in the Bay of Biscay, or lay peaceably at anchor in the French roadsteads, and that this was the particular time when Thurot made his celebrated descent on our coast. He landed at Carrickfergus; and, but for the disputes among his own people, would unquestionably have sacked Belfast. Owing to those disputes he had to leave Belfast Bay, without inflicting any very serious damage, and was destroyed just outside by Captain Elliot. This is all matter of familiar history; but it is worth recalling on the present occasion, because that insult to our coast happened at the very time when our Navy was at its strongest, and the Navy of the enemy at its weakest. It is a striking instance in support of what Admiral Arthur has urged, that it does not do to trust for the defence of our coast entirely to the seagoing Navy: we want also some system of home defence. Other instances might be given, but this is perhaps the most striking. I have noted Admiral Arthur's reference to the institution of the "Sea Fencibles;" and though he does not say much about them, the inference is that he thinks some similar organization might, perhaps, be adopted. It is therefore well to remind the meeting that in 1801, when Lord Nelson was appointed to the command of the defence flotilla, and had charge of the coast from Lowestoft to Dungeness, he wrote—towards the close of his command—that the establishment of "Sea Fencibles" was bad, and that not a man of them, or very few of them, had come forward when wanted. Of course that is no argument against an establishment of "Sea Fencibles," but it points out that that particular form of establishment did not answer the purpose for which it was instituted. Admiral Arthur, speaking of a possible superiority of the enemy in the Channel, says, that if we were outnumbered by hostile ironclads, there would be nothing for it but a land fight for existence within our own borders. It unquestionably is, or ought to be, the first consideration with our Admiralty to prevent such a possibility; but historically the inference is not quite correct. Once at least the hypothetical case happened. In 1779 the enemy, with an overwhelming superiority, had possession of the Channel for several weeks, but did not succeed in invading the country. That they did not do so was, however, through their own bad management, not through any defensive action of ours. Admiral Arthur has thrown out a most important and valuable suggestion that the Government might refuse to grant the use of the British flag to any vessel, unless the majority of her seamen were British subjects. It is one to which I should like to offer my very small endorsement. It is a point that I myself have more than once raised in this theatre, and which seems to me to go home to the very heart of the matter. As long as the bulk of the mercantile seamen sailing under the British flag are Swedes, Danes, Russians, Greeks, Turks, Chinese, and Malays, it is very clear that the mercantile marine cannot be that feeder to the Navy, and that support in time of need, which it ought to be, and of old used to be.

Colonel CAMERON, Commanding 4th Durham Artillery Volunteers: In Admiral Arthur's paper, he remarks that "fortunately our commercial ports are situated upon navigable rivers," but he says nothing much about commercial ports that are abutting upon the sea. I live at Hartlepool, and at that port we have an artillery volunteer corps of eight batteries, who are men well versed in gunnery, but unfortunately we have no guns with which to protect the port. Although there are between 200 and 300 steamers registered at that port, we have nothing to defend them with but two 40-pounder and two or three 64-pounder guns. I think at a seaport like Hartlepool, open to a hostile fleet, where immediately outside the harbour and docks man-of-war ships could anchor and shell the town, in a place like that powerful guns of position should be placed, which could be easily used by artillery volunteers. The artillery volunteers are well capable of manning those guns; they go to Shoeburyness every year and use the

10-inch guns; they never see that gun except when they go there, and yet after drilling a few times with it, they are able to manipulate it almost as well as the Royal Artillery men themselves. I wish to urge upon the authorities that we at Hartlepool should be provided with powerful guns of position, so as to enable us to defend the place if ever it is required.

Admiral Boys: Before the discussion closes I should like to make a few remarks with reference to Admiral Arthur's paper. I regret very much the cause of my good friend Admiral Arthur's absence, and I must congratulate him on the subject which he has brought before us so efficiently. One of my remarks has reference to the matériel and the other the personnel of the Navy. Admiral Arthur implies in his paper, and this view is taken up by a great many naval Officers and others—Sir Robert Molyneux has just touched upon the point—viz., that the torpedo is a weapon that whenever it is launched against an enemy's ship it is to be effective, and that consequently the days of large ironclads are coming to a close. My conclusions are directly the contrary; my opinion is simply this, that the torpedo is a *most* uncertain weapon in the first place, and then, secondly, even if it strikes a ship, it does not follow that that ship is to be necessarily destroyed; it is generally implied that it will be so, and especially by the torpedo Officers themselves. They no doubt think the torpedo is the most serious weapon that we have to deal with; they are educated to think so, and it is clear this paper is written by one of them; but I must say that I think the introduction of the torpedo is only an argument for the necessity of very large vessels, for this reason, that the effect of a torpedo that would sink a small vessel would be scarcely felt by a large one with great floating power, especially if means were taken for her protection. I cannot quite agree with Admiral Arthur's suggestion of a cellular scantling projecting 12 feet from the side of the ship. I think the result of that would be something like the boy learning to swim with bladders, who when he jumped into the water found that the bladders slipped down to his feet, and he floated head downwards. I think that any such construction would materially affect the stability of a ship; but by numerous cellular divisions, or by some modification of Sir Edward Reed's arrangement, a practical and considerable defence may be given against the blow of a torpedo. I regret to find that the opinion is getting so general throughout the country, that the days of large ironclads are gone; it is a very popular one and a very convenient one for the authorities, as no doubt Sir Cooper Key knows, looking at the great difficulty of getting money for the Navy, and especially at the vast sum that is swallowed up in one large ironclad. At the same time it is not fair to expect our Officers and men to do what their forefathers did before them, if we place them in ships inferior in any single point of armour protection, armament, or speed, and expect them to conquer their enemies with those inferior weapons. I say it is not a fair position in which to place our Navy. We must remember the old prestige of our line-of-battle ships, frigates, and our sailing has been practically abolished by the introduction of steam and mechanical appliances. An English man-of-war was always considered more than a match for any of her class in former days, but I am sorry to say the time has come when that belief may be a fallacy. An English sailor will do his best, no doubt, and will be equal to any man, but we cannot infer because he is an English seaman that with inferior means he is to be superior to his enemy. The other point upon which I wish to speak has almost been taken out of my mouth by Mr. Laughton. It was with reference to the Naval Reserves in our merchant ships. I quite agree with Admiral Arthur that it is incumbent upon the authorities as far as possible to bring forward by some means or other those British merchant shipowners that do not employ foreign seamen. I may instance two competing lines of merchant Australian steamers, the "Peninsular and Oriental," and the "Orient." The Peninsular and Oriental ships are manned with very few Englishmen; the Officers are English and some of the petty officers, but the majority of the seamen are Lascars, and I believe the majority of stokers are not Englishmen. In the Orient Line they do not take any foreigners at all. I think the Government should really encourage such conditions, which they might do by giving a preference for transport duty, by mail subsidies, or by placing them first on the Admiralty List, and I think it is only right that they should have that preference with a view to increasing the Naval Reserve. In the matter of the Naval Volunteers I quite

agree with Admiral Arthur and those gentlemen who have spoken so well in their favour. I was connected with them many years ago, I think I may say I was almost the first who advocated the principle of the Naval Artillery Volunteers. I happened in my early half-pay days to be an Officer of a Cinque Ports battery of Artillery Volunteers, and we had our battery in a Cinque Ports brigade, whose services were supposed to be devoted entirely to manning guns to be carried in gun-boats for the protection of our coast. I believe that that was the origin of the Royal Naval Artillery Volunteers, as recommended by the Royal Commission of 1863, and I wish the present race of Royal Naval Artillery Volunteers every success.

MR. COPEMAN: I want to be allowed one word to urge the extreme importance to this country of having torpedo-boats which can be used in rough weather. If we are relying on torpedo-boats as an important part of the defence of this country, it is imperative that they should be able to put to sea in all weathers, and I doubt whether we have any at the present time which could go out of harbour in rough weather.

MR. TRELAWNEY SAUNDERS: I am unwilling that this subject should pass without calling attention to one very important branch of it. I particularly desire to show of what importance the Coast-guard stations might be made, especially with reference to attracting our rural population to the Naval Reserve service, in fact, to the defence of our shores on the sea, not on land, and in encouraging the natural disposition of our maritime population—the population, say, within 20 miles of the shore—towards nautical exercises. I think in that way every Coast-guard station should have its chance of showing the extent to which it might be made an active recruiting station, bringing more of the population of the country forward for the purpose of recruiting the Navy and mercantile marine, and especially for the purpose of defending our shores. I wish to get rid of the idea altogether of the Navy being looked to by Englishmen as an instrument of defence. I want to see it purely an instrument of offence. I would wish to see the regular troops take up the same position, purely as an instrument of offence, capable of being planted at any point on the shores of Europe where they may be wanted, through the instrumentality of a permanent transport service. In that way our small Army would become more threatening and more effective than the large armies we are familiar with on the Continent. To recur again to the question of the use which our Coast-guard stations ought to be for the defence of the country and the manning of the Navy, I cannot help thinking that we ought not to confine our movements with regard to Naval Reserves, Naval Volunteers, and so forth, to the great ports, but we ought to open any Coast-guard station that can influence the surrounding population, in the way of bringing them in as recruits, in the first place for naval defence, the defence of our shores, and in the next place for manning the Navy and the mercantile marine. I feel sure that the question deserves a more popular consideration than is the fashion of the present time. I doubt very much whether you will make the Naval Reserve to be a popular service, such as the military Volunteer Service has become, if you leave it entirely in the hands of naval Officers. I say that with the greatest respect for the naval profession, and for everybody belonging to it. I want to popularize the Service amongst our countrymen. I want to give an opening for every young Englishman, whether rustic or townsman, to become fit to serve his country in the Channel whenever his services may be called upon, and in order to do that you must give encouragement to all classes of our countrymen who are likely to be attracted in that direction; that is to say, there are some young men, tradesmen's sons, sons of gentry, and so forth, who would accept the mere opportunity of appearing in a gay uniform, and take the responsibilities belonging to that uniform, as you have in the military Volunteers, and that is a consideration that I have not heard ventilated in this discussion. I am sure there is an enormous field open to the development of our Coast-guard service, as an instrument for the defence of our shores on the waters of the sea, rather than, as was advocated on a previous occasion, allowing the enemy to land, which is an opinion that I am sure will be scouted by every Englishman. The true battle-field is the water, and that is where we must fight, and determine to succeed, and to succeed independently of the Navy. I hope your attention, and the attention of men qualified to deal with

this subject, and to make it tell upon the country, will be drawn to the capacity of the Coast-guard service and stations as instruments for attracting the rural and town populations towards the defence of the country, and the manning of the Army and Navy.

Colonel HOPE, V.C.,: As Admiral Boys has led the way, I venture to say one word in support of his view, that the days of ironclads are beginning rather than ending; and I will quote Admiral Arthur's paper in support of that assertion, for when he contemplates the loss of the command of the Channel by the English fleet, and the invasion of this country, he instinctively supposes that the invading force is to be *supported by an ironclad fleet*. It seems to me, for in a certain sense these matters can be judged of even by a landsman, that the fleet must always have a backbone in the form of a rallying point composed of the largest possible armour-clad, and I think, instead of stopping at 10,000 or 12,000 tons, we ought rather to go forward to 20,000 or 30,000 tons. But no doubt the notion is a very general one, that the days of ironclads are over, and I think that is the reason why we should be very grateful to Admiral Boys for challenging that statement. However, Sir, an ironclad without guns is, no doubt, of very little use; and that brings me to that unfortunate occurrence of the other day. I am afraid our ironclads at present have no guns, and that would apply also to the suggestion of our friend from the north, who complains that our coast batteries have no larger guns than the old obsolete 40- and 64-pounders. The truth is *we have no guns* in this country. They are all *rotten*.

Admiral FREMANTLE: In endeavouring to reply I must ask your indulgence, because it is extremely difficult, as you will all naturally understand, to speak as two persons, and therefore I must speak rather in my own person, although with great regret that Admiral Arthur is not here to reply for himself, because no doubt several of the statements made by him which have been challenged he would have been prepared to defend, though I may let them go by the board because I do not see exactly how they are to be defended. Captain Mann mentioned several things in which I entirely agree. I certainly do think our Navy should be generally capable of taking the offensive, and if it is not strong enough it should be strong enough. That is touching upon the subject of the lecture we had here the other day from Major Elsdale, and I am I must say, as a sailor, very much more in sympathy with the sentiments in this lecture than I was with the lecture last Friday. As regards the number of first-class steamships required to convey 75,000 troops, stated by Admiral Arthur as 500, I must say when I read it, I thought it was an exaggerated statement. I have taken a little trouble to ascertain what the amount ought to be, and I should say roughly it would be more correct to put it down as 150 ships than as 500. Admiral Arthur may have very good reasons for that statement of 500; possibly he meant to take over provisions for all this large army, and therefore we must suppose, unless it is a misprint, that he had good reasons for saying so. It is one of those cases in which I very much regret that he is not here to speak for himself. As regards the Royal Naval Artillery Volunteers, as to whom a good deal has been said, both by Sir Robert Molyneux and Mr. Smith, I am sure it is not necessary for me to add much to what has been said by the lecturer. It is quite clear we are all in agreement upon that point. The general idea appears to be that they are ready to undertake any duties, that the more work they get the better, and I can only say I am sure Admiral Arthur will be extremely glad if he finds as the result of his paper, or possibly as a result of his paper, that general attention is directed to the services of this valuable corps, and the use that may be made of them, as no doubt we cannot expect them to be as useful as we should wish them to be if they do not have opportunities of perfecting themselves as they would wish to perfect themselves. Captain Curtis referred to the Naval Coast Volunteers of former days—some thirty years back—and he seems to think that a certain number of them were very efficient at that date. I am afraid the general impression amongst those who are old enough to have had any experience of them is, that at all events they would come under the definition of the "Sea Fencibles" in Nelson's time, to which Mr. Laughton alluded. I think they were scarcely as efficient as we could have wished. I am afraid they were rather the scum of the maritime population,

and therefore I can only think that there was some fault in their organization. At the same time one is very glad to hear that, bad as they were generally represented to be, in Captain Curtis's opinion even those men were of some use. I am quite aware Captain Curtis also alluded to the young boys, the fore and aft men; but I do not quite understand how he proposed that they should be brought into the Navy, or exactly how they could be made use of. If it can be done without any very great expense, I think we should all agree it would be a very useful thing to do. The cellular caisson proposed by Admiral Arthur, extending something like 12 feet from the ship's side, was criticized by Captain Curtis, and I think the effect of an explosion on that as affecting the stability was also criticized by Admiral Boys. It seems to me that that is a fair criticism. It was an idea thrown out by Admiral Arthur that some defence of this sort might be established, and certainly it has been proposed by others to have some defence of that sort: in fact I do not think it differs very much from what was proposed in principle at all events by Sir Edward Reed. I was very glad that Mr. Laughton referred to naval history, and to that little episode of 1760, because it does seem to me remarkably important. I am quite sure what Admiral Arthur was alluding to was simply this, that if we are to have a large force landed capable of taking the offensive in England, which he puts at the very moderate army of 75,000, the enemy must certainly have command of the sea for a considerable length of time. I do not understand him exactly if I read the paper aright as stating that it was impossible, under circumstances where they had not command of the sea, to make an isolated attack; in fact it seems to me to rather suppose that was the thing they would do.

MR. LAUGHTON: Allow me to explain. When I mentioned that episode of 1760, I was referring to something Captain Mann had said, in which he seemed to throw cold water on the necessity of defending our ports and harbours, which he thought should be defended by the seagoing Navy at a distance. I brought that forward as showing that at a time when our Navy was exceptionally strong, our ports were still liable to attack.

ADMIRAL FREMANTLE: I quite agree with what has been said by Mr. Laughton. My recollection is now that he was answering Captain Mann. I am very glad the question of British subjects has been referred to by Admiral Arthur and Mr. Laughton, and by Admiral Boys. Of course we shall be told we are interfering with the great principle of Free Trade, but we do not know much about Free Trade in this theatre, and we do not care very much perhaps about the Navigation Laws, but they exist, and we are infringing upon those principles when we talk on those subjects. But Admiral Boys' suggestion, at all events, I think does not infringe on Free Trade nor on the Navigation Laws, and it seems to me to be a very reasonable and fair one, namely, that the Government should give preference to lines which man their ships by Englishmen. At all events it seems to me that that is an invaluable suggestion. There was a reference to Hartlepool. I understand that Admiral Arthur was referring, in general terms of course, to most of our large shipbuilding and mercantile ports being up navigable rivers, and speaking generally this is the case, and on this subject we cannot help recollecting that it has always been our national policy to defend our great naval arsenals,—that our national policy, in modern times, at all events, is to build a very large proportion of not only our smaller vessels, but our ironclad fleet, by contract, and that places like the mouths of the Tyne and the Clyde are just as necessary, or very nearly as necessary, to be defended now as our great naval arsenals of Portsmouth and Plymouth. I am afraid I scarcely agree with the lecturer as to our ironclads, and I am more in agreement with what fell from Admiral Boys and a subsequent speaker upon that subject. I think I can a little convict Admiral Arthur out of his own paper. I hope it won't be thought I am behaving unfairly in doing so, but I must say when people talk about small torpedo-boats they do not speak always entirely by the card. Our small torpedo-boats used to cost about 8,000*l*. Mr. Copeman spoke of boats which he required to be reliable in rough weather, and Admiral Arthur has referred to boats as costing 25,000*l*.; therefore the boat is disappearing into the ironclad. It scarcely seems to be sufficiently considered what we are talking about when we are talking about a torpedo-boat. Of course you may call the "Polyphemus" a torpedo-boat, if you like, but other people

may call her an ironclad. I very much agree with Admiral Boys in thinking that an ironclad, or some large vessel, will and must exist, and that our torpedo-boats may be useful adjuncts to a fleet, but will never take the place of the big ships. With reference to recruiting in the Coast-guard stations, I have not the slightest doubt the Coast-guard stations might be made more use of in that respect than they have hitherto been. I think that is all I wish to say. I quite agree with everybody who has spoken, although I have taken a part once or twice in agreeing with the critics rather than with the author of the paper. I think this is an extremely valuable one, and there is one point which I have referred to, namely, the increasing use of the Royal Naval Artillery Volunteers, that I confidently hope will lead to some little fruit.

The CHAIRMAN: I will only detain you a few minutes before asking you to give your thanks to both Admiral Fremantle and Admiral Arthur. There is one point of importance connected with the defence of our coasts which was neither mentioned in the paper nor referred to by the speakers, and that is the necessity for the provision of fast and well-armed squadrons of ships constantly cruising at sea on every part of the coast of Great Britain and Ireland. With that object we must have harbours within easy reach, and I am of opinion that the great want that now exists for the efficient defence of our commerce and ports on the east coast of England is a suitable harbour of refuge in the vicinity of the Tyne, either at Filey, which offers conveniences for it, or at the mouth of the Tyne. There is not a port to which our squadron could go for coal or provisions, or for refuge in a strong easterly gale, on that part of the coast, and I think in a time of peace the Government could not spend their money better than by constructing a harbour of refuge in that vicinity. They will do even more for coast defence by such a work than by building small vessels for the defence of ports which ought to be provided as well. I cannot speak too strongly on the necessity for such a harbour. No one can speak more warmly of the Naval Volunteers, or appreciate their services, higher than I do. I have known them and been connected with them for years. We have much to thank them for, for having shown an example in giving up their time and money, and in putting themselves to great inconvenience, and enduring what probably would be to them hardships in the work they have volunteered to do. But with reference to a remark by Admiral Arthur, it is not a mere question of economy which has hitherto withheld a capitation grant from them, and that motion has never interfered with the grant. If the Naval Artillery Volunteers are to be extended to form the actual body from which we are to man our torpedo-boats and small vessels for the defence of our coasts and harbours, it is a necessity that it should be composed of seafaring men. Without disparagement to the present corps, it is a fact that not many of them are seafaring men, and therefore I think the Government have done wisely in hesitating to encourage them to extend their numbers, unless we can get seafaring men to join them. Everyone who knows the Naval Artillery Volunteers speaks well of them; it is highly creditable to them to have sacrificed so much solely with a patriotic object; but when you remember that we have about 10,000 first class Royal Naval Reserve seamen for manning our seagoing fleet, and also about 10,000 second class Royal Naval Reserve seafaring men, who have a capitation grant of 4*l.* to 6*l.* a year, and that this latter class are all men accustomed to the sea in steamers or sailing vessels or boats, fishermen, men from coasting vessels, and larger craft, all whom you may call seafaring men,—I think we ought to look about and make use of them for the defence of their own locality, or of the coast all round, as we are empowered to move them as is found necessary. If we can incorporate them with the Naval Artillery Volunteers, we shall then find our force for the purpose of manning torpedo-boats and the like. I think Sir Robert Molyneux mentioned that we ought to consider the difficulty we shall find in providing young Officers to command our torpedo-boats and other small vessels which will be required in time of war. I believe this is one of the most important questions that can occupy the attention of the Admiralty, the provision and the training of young Officers for the command of torpedo-boats and small vessels. What I understand Admiral Arthur to mean by his cellular construction at 12 feet distance from the ship's side is that it should be an outer skin, a cellular double bottom, 12 feet from the original hull. No doubt it

would be a very awkward thing, and, as he says, it will diminish the speed very much. I do not think we shall see that sort of apparatus built outside our ships. But he speaks of air space. Now there are three ways of occupying space for resisting a torpedo blow, one by air, one by water, and another by coal. I think we ought to press forward experiments to ascertain what effect coal will have in resisting the explosion of torpedoes; I imagine it would be far greater than is generally supposed, and much more than either air or water. One word with reference to foreign seamen. It is a matter on which I feel strongly. Admiral Arthur said that no ship should be allowed to go to sea unless the majority of its crew are British seamen. I happen now to be on a Royal Commission that is inquiring into the question of the loss of life at sea, and I can assure you ships rarely, if ever, go to sea with a *majority* of foreign seamen on board. We are so far safe, but that there is a large, a far too large, proportion of them there is no doubt. When we speak of Lascars, we must remember they are British subjects, and I do not think you ought to discourage the employment of Lascars in tropical climates. We ought to hope, though I am afraid we can do nothing more than hope, that the influx of foreign seamen will not increase. The fact is that foreigners, especially Scandinavians, are more amenable to duty than our own men are. You can depend upon their coming on board the day they are told, but it is not the case that they serve for less money; they have the same pay. Any movement that can be initiated or pressed forward to increase the numbers and improve the quality of our seamen, and thus prevent the influx of this foreign element in our merchant ships, would be a very great blessing to this country. I will now ask you to give your thanks to Admiral Fremantle, and will request him to convey your thanks also to Admiral Arthur for his interesting paper, and regret for the cause of his absence.

Wednesday, June 2, 1886.

GENERAL THE RIGHT HON. VISCOUNT WOLSELEY, K.P., G.C.B.,
&c., &c., &c., in the Chair.

MOUNTED INFANTRY.

By Major E. T. H. HUTTON, King's Royal Rifles (late Commanding Mounted Infantry in Egypt).

“ Come the three corners of the world in arms
And we shall shock them: naught shall make us rue,
If England to herself do rest but true.”

Introductory.—In bringing this much discussed question of mounted infantry before the military public, I trust that the fact of my having resumed to do so may not be misconstrued.

This question has been much talked of, and so much has been written and spoken, both in England and on the Continent, upon the subject by civilians and others more or less conversant with it, that it has been deemed a fitting time for putting the matter before the professional public in this hall with a view more especially of inviting that discussion and free criticism from the many experienced and distinguished Officers present, which its importance and interest merit.

Of the general utility of Mounted Infantry and of the excellent service performed on all occasions by them, there can be but one opinion—but there is a difference of opinion as to the necessity for such a force, and also as to its mode of organization should such a necessity be conceded.

It is therefore with regard to these two points that I would more specially invite your attention.

A. THE OBJECT OF MOUNTED INFANTRY.

To provide an improvised Substitute for an expensive Cavalry in small and hastily organized Expeditions.

All military expeditions—no matter how small and insignificant the number of troops employed—must be accompanied by a proportion of mounted men; and whether you call them cavalry, mounted infantry, or irregulars, the functions to be performed by them are the same. In our recent small campaigns, the only occasions when mounted men were not and could not be used were in the Red River Expedition of 1870 and in the Ashanti War of 1873-74. In the case of the Red River Expedition, the column being conducted throughout by water, no means existed for supplementing the force so despatched by any mounted troops for scouting purposes. Again,

in the Ashanti Campaign the bush was so dense that no draught animals, or beasts of burden even could find their way through, so that the scouting and legitimate work of mounted troops had necessarily to be performed, as best it could, by native irregulars.

We have in India a magnificent force of irregular cavalry; it is therefore mainly in our expeditions sent elsewhere that the legitimate cavalry work has to be arranged for, and where any available means on the spot have necessarily to be utilized for that purpose.

Our recent wars and expeditions have repeatedly warned us how helpless infantry must be when acting alone. A few mounted men would have prevented the surprise and disaster on the Intombi River in 1879. A few dozen mounted men, as scouts, who understood their duties, would have averted the catastrophe at Bruncker's Spruit in 1881, and with that the loss of our military prestige in South Africa and all its fatal results.

Later in the same campaign a force of mounted men properly equipped and carefully trained would in all human probability have saved our arms from defeat at Lang's Nek and the Ingogo River. At Lang's Nek, by occupying the fatal kopje from which some thirty or forty mounted Boers poured in a destructive flanking fire upon the advancing column of the 58th; and at the Ingogo fight by first of all ascertaining exactly the position and force of the Boer force opposed to our small column, and subsequently during the engagement by preventing the Boer horsemen from enveloping both our flanks and enclosing our little force in an almost complete zone of fire.

There was indeed a small makeshift force of mounted men used at Lang's Nek, but they had been so hastily equipped, and were so completely untrained, that many fell from their horses in riding up the slope of the position, and it was said at the time that to place such men in opposition to the Boers, was to court disaster.

In 1882, upon the arrival of our advanced troops at Alexandria, the first orders issued by Sir Archibald Alison were for the organization of some mounted infantry, and the importance of the work they performed, our comrades of the Navy and Marines were the first to gratefully acknowledge.

Instances such as I have quoted can be amplified *ad libitum* by those present whose experience is much more extended than mine. The fact which I wish to press upon your attention is, that to have available in all infantry battalions a small supply of men who can be used for such purposes as scouting and reconnoitring, is absolutely essential to the success of all our small expeditions.

Our cavalry cannot be counted upon for such purposes—their number is too limited to admit of their being frittered away in every quarter of the globe where we have troops stationed.

After the Zulu and Boer campaigns this principle was temporarily conceded in South Africa—and one company per infantry battalion was mounted.

It is by no means necessary that even abroad a certain proportion of men should be mounted permanently, but it is essential that there should be available in the ranks of every infantry battalion a small

nucleus of Officers, non-commissioned officers, and men, who in an emergency could be mounted, and made at once, when occasion arises, into a corps of mounted men.

Such men might be employed for the regimental transport in a European war.

It is not fair to suppose it possible that infantry soldiers can be equipped and given horses one day, and be told to engage an active enemy the next. It was a favourite saying of Lord Clyde that if "you put men in a false position, the best will misbehave." It is not, recollect, the training of the men only which is so much the difficulty as the ignorance on the part of all concerned, Officers and men, of everything connected with the interior economy and management of horses upon a rough and ready scale.

Efficiency in a mounted force consists in the existence of a sound system of interior economy and stable management.

My critics will argue no doubt that on all expeditions a proportion of cavalry to the infantry detailed should be employed for the work which I would have carried out by mounted infantry, to which I reply that we have neither the cavalry soldiers nor horses to so employ. If we are to have in our cavalry an establishment of men and horses which would make that force adequate for the purpose of all minor expeditions, we must be prepared to double the expenditure upon that arm.

Allow me to give a rough estimate of the respective expenses of cavalry and mounted infantry as placed in the field at Suakin in March, 1885.

(a.) 4 Squadrons of cavalry, say 24 Officers, 400 men, and 400 horses.

(b.) Mounted Infantry 2nd Battalion, in round numbers say—

| | | |
|---------------------------------------|-----------|---------|
| 24 Officers | 48 horses | } = 448 |
| 400 non-commissioned officers and men | 400 „ | |
| (a.) 400 cavalry horses at £70 | | £28,000 |
| A cavalry horse purchased as a | | } = £70 |
| 3 year old..... | £40 | |
| 2 years keep at £15 per annum.... | £30 | |
| | Total | £28,000 |

| | |
|---|---------|
| (b.) 448 mounted infantry, Arab ponies purchased in | |
| Egypt at £26 each | £11,648 |
| Mounted Infantry soldiers, extra clothing 400 at | |
| 50s..... | £1,000 |

| | |
|------------------------------------|---------|
| Pay same in both cases. | £12,648 |
| Equipment and horse furniture, &c. | |

Our German critics ask cynically, Why do you create a hybrid of nasty and therefore doubtful organization, when you have already cavalry and infantry? Why make infantry do cavalry work?

To which queries we, with the experience of small wars conducted at 5,000 and 7,000 miles away from England, reply that our Army being so small—the men composing it must be prepared to perform duties of

a varied nature as emergencies demand. In North America we have to march in snow-shoes or portage boats, in South Africa we must swim rivers, drive ox wagons, and ride half-broken horses. In India and in Egypt we have to march over trackless deserts under the fiery rays of a tropical sun, to ride camels, to row and portage boats up well-nigh impracticable cataracts.

In each and every country our Army has to adapt its tactics to its foes. No German critic seems to recognize that the requirements of our Service necessitate something beyond the stereotyped rules of war. The work required by British soldiers, aye and sailors too, is as varied as the climates under which they serve.

2. To provide for a Campaign on a large scale an efficient Auxiliary to our Cavalry.

It is, I imagine, an open secret that arrangements were under consideration last spring for placing two Army Corps of British troops, or 60,000 men, in the field, presumably to operate in Asia Minor. The proportion of cavalry required would be 10,000 or eighteen regiments.

There were at the time I allude to seventeen regiments of cavalry upon home service, of which at least four would necessarily have to be retained at home in addition to the dépôts. Thus May, 1885:—

| | Officers. | All ranks. | Horses. |
|--|-----------|------------|---------|
| England. Household cavalry, 3 regiments | 70 | 1,196 | 838 |
| Line regiments, 8 „ | 177 | 4,357 | 2,729 |
| Scotland. „ 1 „ | 21 | 472 | 297 |
| Ireland. „ 5 „ | 114 | 2,699 | 1,667 |
| Total..... | 382 | 8,724 | 5,531 |
| 1st Class Army Reserve (B and C) | .. | 1,861 | |
| Grand total | 382 | 10,585 | 5,531 |
| Deduct horses, ¹ 30 per cent. for 3- and 4-year old and worn out horses | .. | .. | 1,651 |
| Total available..... | 382 | 10,585 | 3,881 |
| War establishment of 17 regiments of cavalry, inclusive of dépôts. Total.... | 476 | 10,211 | 6,800 |
| Wanting to complete | 94 | .. | 2,911 |
| In excess | .. | 374 | |
| From the above totals deduct the dépôts of 13 regiments ordered for service, and the total establishment of the four regiments remaining at home | 130 | 4,042 | |
| Leaving to be made up by an improvised force to complete 10,000 mounted men. | 170 | 3,831 | 3,000 |

¹ Estimate of Colonel Keith Fraser, and quoted by Colonel Russell in his recent lecture.

It is thus to supply the deficiency above pointed out that we should require an improvised force of mounted infantry.

Two or three battalions of picked infantry mounted on Syrian horses or Karamanian ponies would be able to relieve the cavalry of many of their most trying and irksome duties—such as vidette and outpost work—orderly duty, and escort. It should then be possible to save the big English horses of our cavalry much of the exposure and hard wearying work which in a tropical and uncongenial climate so soon destroys their efficiency as a tactical unit on the field of battle.

An infantry soldier mounted on a country-bred rough pony is equally if not more at home on outpost duty in a close and difficult country than is his comrade of the cavalry, booted, spurred, and heavily accoutred. Relieved thus of many of their most trying duties, our numerically weak cavalry would be in a position to undertake reconnaissances and raids on an extended scale, and to be always ready and in hand to engage the masses of an enemy's cavalry.

Our cavalry may be said to be inexpansive, and to maintain the thirteen cavalry regiments up to their strength for a campaign would engage all the resources and energy of the dépôts and regiments on home service.

A cavalry soldier must be well trained as such before he is of any use, and the horse no less than the man. Such training requires time, at least eighteen months most cavalry authorities state.

With mounted infantry this is not so. Given experienced Officers, a sprinkling of non-commissioned officers and men, who have had some previous knowledge, a sufficient training can be given in a very short space of time to enable men to ride for all practical purposes of mounted infantry.

Bear in mind that a mounted infantry soldier is merely a selected infantry man with the increased power of locomotion which a horse, pony, mule, or camel may give him. The great difficulty is to obtain the requisite number of experienced or trained Officers, non-commissioned officers, and men to knead the remainder into shape, and unless such are forthcoming when occasion requires, the most serious delay must necessarily follow in placing such a force in the field.

I would add here some remarks upon the principles of training required for mounted infantry. I have always found that Officers and men upon first joining appeared to think that the drill, steadiness, and even discipline of an infantry soldier were to be exchanged for an irregular, slap-dash, helter-skelter method of manœuvring and doing their duty. It is this idea which is the most difficult to combat. It has to be most strongly impressed on all that it is the extreme steadiness and most complete discipline which alone can make mounted infantry useful in the numerous critical situations in which they are called upon to act.

While upon this subject I would earnestly press upon the military public the paramount importance of the very strictest attention being paid to the details of drill, and the minutiae of the interior economy in everything which affects the soldier. Indeed, gentlemen, it is in

the closest adherence to routine, to rules, and to orders definitely laid down upon which we must base the foundation of true discipline. It is the tendency of the present day, by the increase of education, the increase of political freedom, to place all men on an equality, and if it be our sole object to raise the moral power of men generally, no other or better effect could be wished for, but beware how this feeling spreads itself among the ranks of the Army in a manner tending to snap the cords of discipline.

I fear that there is creeping into our Army the feeling that strict unthinking obedience, and the careful adherence to the smallest details of drill or duty, are no longer required of a soldier educated in the more scientific lines of a modern soldier's career. That extreme steadiness on parade (the pride of British infantry)—that complete control under fire—that unflinching coolness in moments of danger, which are the outcome of a mechanical discipline alone acquired in time of peace during the monotonous days of barrack life, are becoming more and more rare. Do not let us delude ourselves upon this point.

Obedience, submission, discipline, courage—these are the characteristics which make a man; they are also those which make the true soldier. Out of this it is only soldiers' discipline which can bring the full force and power, and it is discipline which at once calls out and directs their energies.

I am prompted to make these remarks, because I feel that I am expressing the opinion of those more competent to judge than myself, that the result of the loose formations necessitated by the accuracy of modern firearms, and the increased rapidity with which tactical manoeuvres on a field of battle must necessarily be executed, have been to destroy in a very serious degree that steadiness and solidity of our troops in action, and to have reduced to an alarming degree the cool and deliberate execution of orders in moments of danger and excitement. Those of my hearers who have taken part in the recent campaigns will undoubtedly corroborate my assertion that our "fire discipline" is most defective. Consider, further, the haphazard and irregular manner in which the Attack Formation is practised—the formation which of all others requires extreme steadiness and cool precision.

Discipline, and true discipline, is more closely allied to the careful attention to the number of inches to a pace, or to the length of a strap, or the position of a buckle, than unthinking men will perhaps allow.

Moral discipline, or the power of a strong will over a weaker, is what we pray for, but the qualities that produce it are not common. I may almost say they are rare! Nothing then in their absence remains but mechanical discipline, and it is that which I would impress upon you as being of such paramount importance.

Mechanical discipline it is, grafted upon the strong individuality of the Anglo-Saxon, that has given British infantry the character of being the finest in the world. Let us maintain our birthright!

3. *To provide a Force of Selected Infantry sufficiently mobile to act as such in conjunction with Cavalry.*

Jomini, the well-known commentator upon the great military feats of the commencement of this century, tells us in his "*L'Art de la Guerre*," "It is certainly an advantage to have several battalions of mounted infantry who can anticipate an enemy at a defile, cover a retreat, or scour a wood."

We know that Napoleon the Great specially raised and equipped his dragoons for that very purpose; but that they lost their characteristics as cavalry almost immediately, is also well known.

No one who, even at Aldershot, has seen the dismounted dragoon or hussar struggling with clanking sword or jingling spur, encumbered with long boots, and crowned with an impossible though showy head-dress, can doubt for a minute what the result of a skirmish in a defile or a struggle in a wood would be when such were called upon to encounter an active and self-reliant body of infantry marksmen.

The arms in the hands of a cavalry soldier would place him at a sad disadvantage on foot in an encounter with an infantry man; the carbine and sword is no match for the rifle and bayonet.

I venture to submit that as a certain proportion of artillery is considered indispensable for the effective support of cavalry, so also is a proportion of carefully selected and mobile infantry necessary. The enormous power and increase of range in infantry fire must necessitate the employment of infantry to protect and cover the movements of cavalry from an enemy's infantry, and I feel sure that such will be found the case in the next campaign between civilized Powers.

The great consensus of opinion points to the fact that cavalry cannot be used effectively as infantry.

Rogniat, in his "*Considérations sur l'Art de la Guerre*," published at the close of Napoleon's great campaigns, says: "It is impossible to train the same man to consider himself invulnerable against cavalry when on foot, and alike irresistible when mounted. For that reason the dragoons are despised alike by infantry and cavalry."

General Rosser, of the American Army, stated at the conclusion of the War of Secession: "The cavalry soldier should never be dismounted to fight if you expect him to ride over masses of infantry, and he should be educated to believe that nothing can withstand a well-executed charge of cavalry."

One of our own best known authorities upon cavalry writes: "Cavalry must be armed with firearms, but if used as infantry they will very soon lose faith in the sword and lance, and become quite useless as cavalry. You will never get such to accomplish what was done at Balaklava or at Rezonville."

B. THE ORGANIZATION OF MOUNTED INFANTRY.

1. *The best System for improvising an Efficient Force of Mounted Infantry, having due regard to Expense and the Means at our Disposal.*

The system by which that part of the Mounted Infantry Camel Regiment furnished from battalions at home was raised is, I consider, by far the best. It is undoubtedly the most satisfactory and the most popular among Officers and men, while at the same time it leaves the regiments on the theatre of operations intact.

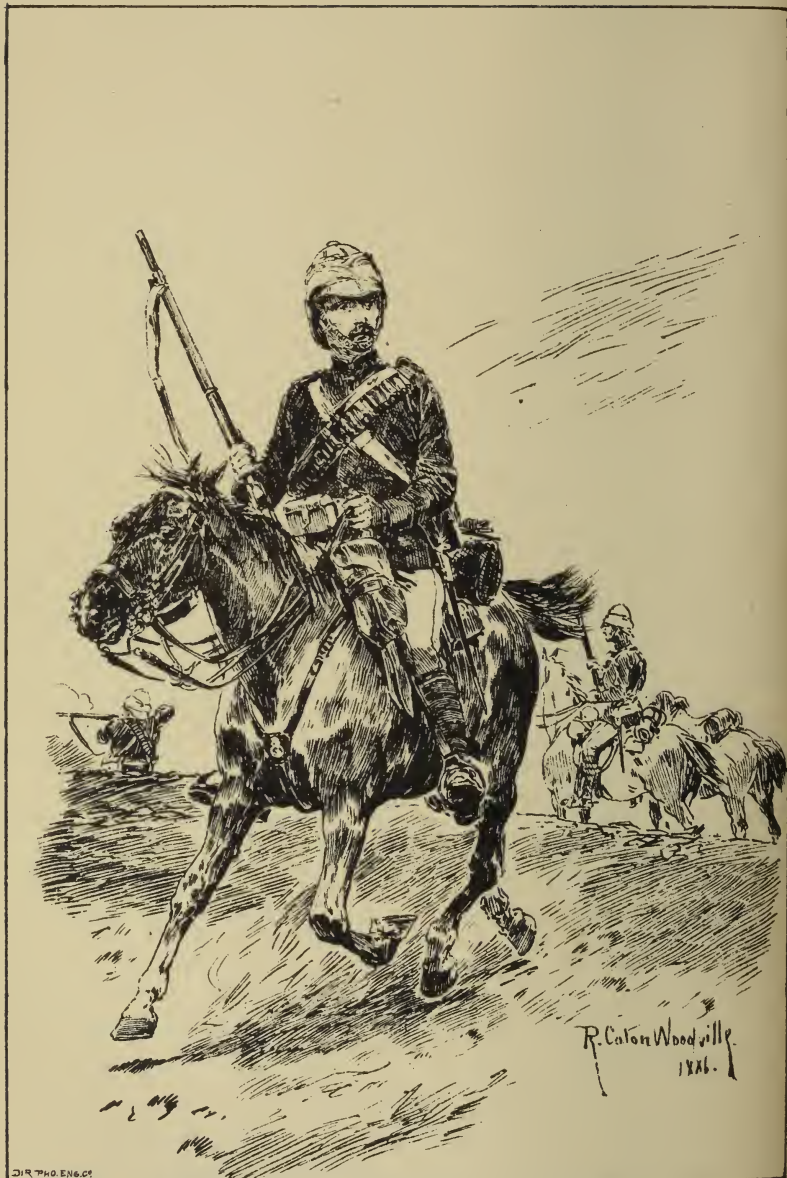
It was briefly this : Certain infantry battalions were selected, and their Commanding Officers were communicated with, and requested to detail a detachment complete for service in the Soudan of 1 Officer, 1 sergeant, 1 corporal, and 25 privates. In some cases a particular Officer was asked for, provided there was no regimental objection.

The detachment thus composed formed one of the four divisions of the mounted infantry company, and remained intact in the corps, forming a small unit representative of the regiment to which it belonged.

This system has the advantage of promoting great *esprit de corps* and emulation among the men, while Commanding Officers of the regiments furnishing the detachments take the greatest pains to select only non-commissioned officers and men in whose hands they feel that the honour of their regiment will be safe. Indeed the Commandant of a corps composed of detachments thus selected has little to fear ; he may rest assured that, come what may, the men will acquit themselves as a *corps d'élite*. This plan has proved most popular.

The principle of taking detachments from regiments on service for this duty should never if possible be resorted to. You extract, in doing so, from each company in an infantry battalion the four or five best soldiers and leading spirits, men whose example and moral influence among the many young soldiers of our battalions is simply invaluable. Such a principle is vicious in the extreme, and one against which every good Commanding Officer kicks.

Again, to form a corps by calling for volunteers from infantry and cavalry regiments, as was done in forming the mounted infantry for service in South Africa during the Boer War of 1881, is unsatisfactory in the extreme. As a rule the waifs and strays of regiments volunteer, and to create an *esprit de corps*, and to obtain any degree of efficiency in a regiment so formed, is a long and serious undertaking. It was entirely due to the great power of organization, tact, and intimate knowledge of his profession possessed by its Commanding Officer, the late deeply-lamented Colonel Percy Barrow, that this corps was placed in the field in the rapid manner that it was. Such men, alas, are rare ! and the Army has lost by the early death of this distinguished Officer one of the very few men who combined the power of organization with the all-important gift of leading men. After Colonel Carrington, of South African renown, Colonel Percy Barrow may be said to be the father of the present system of mounted



DIR PHOTO. ENG. CO.

MOUNTED INFANTRY SOLDIER.
2nd Battalion Mounted Infantry
as equipped and Mounted for Service at Suakim, March, 1885.

infantry, and the views that I have endeavoured to lay before you this afternoon were fully shared by him.

The best manner undoubtedly of improvising a corps of mounted infantry for a campaign is to form it by detachments complete from those battalions which are the least likely to be required for service. I shall refer later on to this system, and how it may be advantageously applied to the formation of a volunteer brigade of mounted infantry.

With regard to the arms and equipment for mounted infantry, I very strongly urge the necessity of some additional weapon to the rifle and bayonet—some weapon which will enable a man to defend himself when mounted, acting, for example, as a scout. A revolver, or still better a double-barrelled pistol, would best answer this requirement.

In 1882 every fourth man received a revolver, which was supplied by the Navy. A cavalry sabre, which has been at times issued to mounted infantry, is a useless incumbrance, as to wield a sabre requires ability as a horseman, steadiness on the part of the horse, and knowledge of the weapon quite beyond the capabilities of an infantry soldier or the power of his beast.

I trust that the days of the sword-bayonet are numbered, and that a weapon which has positively no recommendation but that it *may* be used to cut down small brushwood, will soon cease to be an authorized sidearm for the unfortunate soldier who has to trust in it. It is heavy, it is cumbersome, and it is useless to cut or to thrust with; if used in the latter capacity it cannot be disengaged, and it then almost invariably either jams the foresight of the rifle or damages the spring.

2. *The Necessity for some previous Training, and a General System of Organization for Mounted Infantry.*

If, therefore, it be conceded that mounted infantry are necessary, either as an adjunct to or as an auxiliary to our insufficient cavalry, we should be prepared to adopt some system which would give both Officers and men of infantry regiments the necessary training.

This object might be best and most readily obtained by a school and cadre corps of mounted infantry to be established at Aldershot. To this might be sent small detachments complete of 1 Officer, 1 sergeant, 1 corporal, and 25 privates from certain specified infantry regiments, those probably which are the first for foreign service, and are in the highest establishment. The men would go through a three months' training in the duties of mounted infantry, and for the last fourteen days might be further put through a short course to teach them the essentials of the work connected with wheel and pack transport, *i.e.*, driving wagons and how to load and unload pack animals, and other details. Two such detachments should be trained before any infantry battalion went on foreign service, so that there would be available 2 Officers and 54 non-commissioned officers and men for any mounted work necessary.

A complete roll of the Officers and non-commissioned officers and men so trained would be kept at the school, specifying the proficiency

of each, so that in case of war or necessity arising, it would be comparatively easy to obtain the staff necessary for raising any force of mounted troops. I more particularly allude to this in my volunteer scheme for a national emergency treated on later.

The school itself, consisting of a limited number of Officers and instructors, would be the nucleus upon which a large corps could be embodied.

The training might be carried on by utilizing cast horses from the cavalry. A scheme embodying the principles I have suggested was prepared two years ago, and is in the hands of the authorities, by which it was shown that for 5,113*l.* per annum, including the cost of forage and all expenditure, 12 Officers and 300 non-commissioned officers and men could be put through such a training annually; not a very high price to pay for an efficient auxiliary to our cavalry!

Some volunteer battalions have recently followed the instinctive want for a larger proportion of mounted men, and have added mounted infantry companies to their establishment. This move is most popular, and has been surprisingly successful. The authorities are now, I understand, encouraging the movement. This is a wise course enough; but if any real degree of efficiency is to be maintained by these isolated mounted infantry companies, instructors must be provided, and the men themselves taught on one recognized system, both of drill and interior economy.

To ensure this, a school as I have described above must be provided, and the want of some place where Officers, non-commissioned officers, and men can be taught the very simple principles of a mounted infantry man's work, is keenly felt by those enterprising Commanding Officers who have originated the movement.

If the present incipient movement continues, but is not conducted upon some recognized mounted infantry lines, the mounted companies will very speedily become a species of yeomanry, that is, will exchange their infantry characteristics for those of light horsemen.

This would be to destroy the *raison d'être* of such a force.

3. *The Objections to a Permanent Corps.*

Some military authorities have advocated a permanent corps of mounted infantry. I venture to submit that this would entirely defeat its own object. Organized during peace, and acting with cavalry, it would be impossible to prevent such a force becoming a very indifferent cavalry. An infantry soldier would, under these circumstances, soon lose his identity as such, the temptations to become a cavalry soldier would prove too strong. There is no reason to suppose other than that a corps of mounted infantry permanently organized would share the same fate as the dragoons of Napoleon the Great, and would gradually abandon the less attractive rôle of their duty as infantry for the more dashing one of the traditional "bold dragoon."

Then, again, to raise a corps of mounted infantry is to add the expenses of an extra cavalry regiment to the Budget, and the already

groaning taxpayer would hardly be content to endorse such a step unless for very strong reasons, which it appears to me would be difficult to give.

C. VOLUNTEER FORCES MOUNTED INFANTRY.

The extraordinary disproportion between the mounted branch and the infantry branch of the Volunteer Forces has been so often pointed out, and is so universally admitted, that any effort to obviate the difficulty should be met by every possible encouragement.

To quote the statistics last year :—

| | |
|--|---------|
| Militia infantry | 102,822 |
| Rifle volunteer infantry | 173,047 |
| | <hr/> |
| Total | 275,869 |
| Yeomanry cavalry, present training, 1885.. | 9,779 |
| Light horse volunteers | 292 |
| Mounted rifles | 40 |
| | <hr/> |
| Total | 10,111 |

N.B.—Yeomanry enrolled, 11,590.

I have, I think, shown very conclusively how inadequate is our force of mounted troops, and how pressing would be the necessity of augmenting their number in case we had to put forth our greatest military strength, and embark in a campaign upon some theatre of war beyond our own shores.

With this difficulty in view the following plan was drawn up in March, 1885, was submitted to, and highly approved of by the highest military authorities.

A Scheme for raising a Brigade of Mounted Infantry Volunteers (four battalions for immediate Service in the Field wherever required).

The great consideration which must influence any scheme for the sudden expansion of Her Majesty's disposable forces for service in the field would be how the latent military power and soldierly qualities of the Volunteer Force might best be utilized.

We have in our volunteer regiments of England and Scotland the very material which, properly equipped, and with but very little training, would make the most effective and brilliant description of mounted infantry imaginable.

Taking into consideration the military spirit of the nation, and of the Volunteer Force in particular, there would be no difficulty in obtaining from certain selected battalions of the volunteers sufficient men who would be both anxious and willing to serve wherever required in case of an emergency arising.

Each battalion so selected would contribute a small detachment complete in Officers, non-commissioned officers, and men, and form a

division in each mounted infantry company. Each of the four divisions which compose a company would remain intact, and represent the corps to which it belonged, the company in its turn representing the volunteer battalions of a particular county.

Conditions of Service.—Volunteers enrolled thus should be paid at cavalry rates, and every expense of equipment, rations, and horses should be borne by the public. A bounty would be given the men upon enrolment, and a farther lump sum paid at the termination of their service.

The following should be the conditions of service:—

(a.) Enrolment to be voluntary.

(b.) Candidates must have at least two years' service as "efficients" in the Volunteer Force, and must have qualified as first class shots or marksmen in two distinct courses of musketry.

(c.) Candidates must be recommended by the Officers commanding their companies and battalions as being suitable for the duty of mounted infantry, and as being likely from their good conduct and intelligence to bring credit upon the corps to which they belong.

(d.) It is desirable that preference should be given to men who can ride, or who have some knowledge of horses.

(e.) *Age.*—Not to exceed thirty years, nor to be less than twenty-one.

Height.—Not less than 5 feet 6 inches, and 36 inches round the chest.

Physique.—To be of hardy physique, and each candidate must have a doctor's certificate pronouncing him fit for service in any climate.

The enrolment should be for six months, renewable at the option of the Secretary of State for War for twelve months, for service wherever required.

(f.) The Secretary of State for War to have the power of disbanding the battalions at any time upon giving one month's notice or one month's pay in lieu of such warning. The Secretary of State for War will have the power of dispensing with the services of any individual at any time, either on account of misconduct or unsuitability.

(g.) A complete mounted infantry soldier's kit, including necessaries as per accompanying Appendix marked I, will be issued to each man on joining.

Horses.—The battalions thus enrolled should be mounted on Hungarian or Syrian horses. The latter are most strongly recommended, because they are small, compact, and very hardy.

Place of Assembly.—It would be advisable to assemble the companies and battalions at Aldershot, where they would receive their equipment, and where their instruction might be at once begun; horses cast from the cavalry being used for the purpose.

Time required.—Given the horses, and competent Officers, with the personnel suggested in the accompanying schedule, a fortnight would be sufficient time to have a brigade thus constituted in a sufficient state of efficiency to take the field.

Under the present conditions it would be most difficult to find Officers even, and much more non-commissioned officers of the

regular Army, who would be competent to do justice to this force, though there are doubtless many first-rate Officers and non-commissioned officers who could and would be forthcoming. If this mounted infantry school were organized as suggested, the difficulty would be at once solved, and from the list existing in the school there would be no hitch in providing a fair proportion of the Officers and non-commissioned officers required, who had had the requisite training.

Organization. Division.—Each detachment from a volunteer battalion composes one out of the four divisions which make up the mounted infantry company as per M.I. Regulations issued with G.O. 1 of 1884.

The division consists of :—

- 1 Officer (Subaltern or Captain).
- 1 Sergeant.
- 1 Corporal.
- 25 Privates (exclusive of Officers' servants).
- 1 Bugler. This for every two divisions.

Company.—The company should be commanded by a Major or Captain of the regular Army selected for his special qualifications by H.R.H. the Commander in-Chief.

The company to be thus composed :—

- | | | |
|--------------------------------|---|--------------------------|
| 1 Captain or Major | } | From the regular forces. |
| 1 Company sergeant-major | | |
| 1 Farrier | | |
| 2 Shoeing smiths | | |
| 2 Saddlers | | |
| 1 Riding instructor (sergeant) | } | |

with four divisions, viz., 4 Officers, 108 non-commissioned officers and men.

Battalion.—Each battalion should consist of four companies. There should be a Commanding Officer and second in command. The battalion staff to be as follows :—

- | | | |
|--------------------------|---|--------------------------|
| 1 Commanding Officer | } | From the regular forces. |
| 1 Second in command | | |
| 1 Adjutant | | |
| 1 Quartermaster | | |
| 1 Medical Officer | | |
| 1 Veterinary Surgeon | | |
| 1 Sergeant-major | | |
| 1 Quartermaster Sergeant | | |
| 1 Paymaster Sergeant | | |
| 1 Orderly-room clerk | } | |

Brigade.—The brigade should be composed of four battalions. The staff required would be as follows :—

| | |
|-------------------------|----------------------------|
| 1 Colonel of the Staff | } From the regular forces. |
| 1 Orderly Officer | |
| 1 Staff Officer | |
| 1 Paymaster | |
| 1 Military Staff Clerk | |
| 1 Assistant Staff Clerk | |
| 1 Paymaster's Clerk | } |

Note.—In the accompanying suggested plan, those counties have been selected to furnish detachments which have the largest number of volunteer battalions: and those volunteer battalions in each county have been detailed which show the largest number of Officers available in proportion to their establishments.

Attached is also a form, marked Appendix III, showing the establishment of each division, battalion, and of the brigade, including that of the horses, upon the lines laid down in Mounted Infantry Regulations.

2. *Proposals for Officering a Force so Raised.*

I acknowledge that to find Officers of volunteer corps suitable to command the detachments furnished by their corps might be a difficulty. It is most desirable that each detachment should be representative of its own battalion, but if no Officer is to be found who is willing or who is suitable to undertake such a duty, it should then lie with the Officer commanding the regimental district to recommend an Officer from the yeomanry or even militia of the county to join and assume command, should he be otherwise qualified.

It is of the utmost importance that the Officer should if possible belong, if not to the corps providing the detachment, at least to the county with whose title the company would be associated.

3. *Remarks upon the Yeomanry.*

It is to be hoped that the movement which some of the leading Volunteer Commanding Officers, like Lord Mount Edgcumbe, Lord Wantage, and others, have initiated in their regiments, the 5th Devon, the 1st Berks, &c., may be speedily developed on a large scale. There is also a very growing opinion that the yeomanry should become mounted rifles, and I cannot but think that the grant of 80,000*l.* per annum would be much more beneficially spent if devoted to their training as mounted infantry, than to the present vain attempt of making an efficient cavalry in six days' training per annum. The work and duties of mounted riflemen are those most thoroughly congenial to the sporting instincts of English and Scotch yeomen farmers, or that class of individuals which you especially wish to attract into the ranks of the yeomanry and volunteer service.

You would thus possess mounted battalions of men accustomed to horses and trained as riflemen, who would be useful and efficient,

in place of half-trained men upon horses untrained to be ridden in the ranks, from whom, man and horse, it is alike unreasonable to expect any high degree of efficiency as cavalry.

Again, England is ill adapted to the movements of cavalry, in fact except in some isolated districts the country is so cramped and intersected by enclosures and woods that the movements of cavalry as such would be necessarily confined to the lanes, roads, and commons, where a few well-placed mounted infantry would be more than a match for the most dashing squadron of cavalry.

This radical change in the character of the yeomanry would, I am convinced, be not only eventually popular with the class from which it is recruited, but the country generally would feel that it had at its disposal a practically useful and valuable body of horsemen, and that the advantages of the yeomanry were something more than nominal.

D. REMOUNTS IN TIME OF WAR FOR IMPROVISED MOUNTED TROOPS.

In conclusion, I beg to offer a table, Appendix IV, showing the number of horses available for the purpose of mounting an improvised corps, and to be obtained at short notice from Arabia, Syria, and Asia Minor.

The information it contains is the result of personal investigations during the time that I was President of the Remount Committee in Egypt.

The remount question has been most ably treated by Colonel Frank Russell from the cavalry remount point of view.¹ The class of horse with which my table deals is one suited to mounted infantry or to irregular cavalry, rather than to cavalry who are expected to act as a formed body on the field of battle, and whose weight must necessarily be sufficient to ride down an enemy's cavalry or broken infantry.

The question of horse supply is one of the greatest importance, and I have therefore ventured to supplement my paper by some information on the subject which may contribute to allay the anxiety generally felt as to the extreme difficulty of obtaining the number of animals requisite for our wants in a national emergency.

I may add that all horses purchased in Syria or Asia Minor are sufficiently broken for practical purposes—indeed, when raising a battalion of mounted infantry in Egypt in the spring of 1885, horses were bought in the open market one day, and ridden by untrained mounted infantry soldiers in the ranks the next, no mean test. Average height, 14.1; average price, 26*l.*; age from five upwards.

These horses did most admirably in and about Suakin last year, and their powers of endurance astonished everyone. It was precisely this description of horse which the late Colonel Percy Barrow had for his detachment of the 19th Hussars, when accompanying Sir Herbert Stewart's column across the desert. Upon one occasion he mentions that his horses were fifty-two hours without water.

It was, I believe, suggested at Colonel Russell's lecture, that

¹ See Journal, vol. xxix, No. CXXXII, p. 1045, *et seq.*

Canada will be the country to which we should look for remounts for our cavalry, and Lord Melgund, who at that time had only just returned from Sir F. Middleton's short but brilliant campaign in the Far West, especially drew the attention of the audience to the excellent class of horse to be procured from the ranches of North America.

Horses are bred in great numbers, as is well known, upon the distant prairies of North America, and I am informed, upon the best authority, that a very large number of horses can be purchased on the slopes of the Rocky Mountains for an average price of 20*l.*, over 15.2 in height, and from five to seven years old. It is estimated that these horses could be landed in England at an average cost of 10*l.*, making the total price for each approximately 30*l.*

Considering the enormous price now paid for our cavalry horses, estimated as I have shown at 70*l.* each by the time they are five years old, it may well be a matter of interest to inquire whether a remount agency established at some point upon the Canadian Pacific Railway would not be a satisfactory solution of what is fast becoming a very pressing and urgent question.

It is well known that live stock in great and still increasing numbers are imported from America, and I submit as a suggestion to those more competent to judge, whether some such plan might not prove better and more economical than the present one by which our cavalry Commanding Officers are bidding against one another, through dealers in the open market, for horses which, when purchased, have to be kept until they are sufficiently matured to take their places in the ranks.

I trust that I may be excused for offering these few remarks upon the remount question, with which Colonel F. Russell has so ably dealt, but the question of mounted infantry or the improvisation of a force of mounted men, is one which must be considered together with the question of whence their beasts are to be procured, and I hope that it will not be supposed that I have thereby wandered from my subject.

Gentlemen, in conclusion, I must thank you for a patient and considerate hearing. I feel that I have not done justice to the very important subject upon which I have endeavoured to invite your attention.

My principal motive in addressing you this afternoon has been to show how inadequate is the proportion of mounted troops to the infantry which it is in our power to place in the field, should occasion demand it. With this object in view, I have endeavoured to demonstrate how an impromptu force of mounted men, whether composed of regulars or of volunteers, could be raised, and could be most effectively placed in the field at short notice to meet this deficiency.

I trust that some of the distinguished Officers present will add their more matured opinions upon the questions which have been raised, and allow me in conclusion with the poet to add—

“ For still we hope
That in a world of larger scope,
What here is faithfully begun,
Will be completed not undone.”

APPENDIX I.

MOUNTED INFANTRY.

The following articles of equipment, necessaries, and saddlery are required to be in possession of every mounted infantry soldier, and will be carried as follows:—

1. *On Person.*

| | | |
|-----------------|----------------------------------|---------------------------|
| Helmet | 1 guernsey | rifle and sight-protector |
| 1 flannel shirt | 1 kharkee coat | bayonet and scabbard |
| 1 „ belt | 1 water-bottle | waist-belt |
| 1 pair drawers | 1 haversack | side pouch |
| 1 „ socks | 1 knife and lanyard | 70 rounds ammunition |
| 1 „ pantaloons | 1 oil-bottle | revolver and case, and |
| 1 „ putties | 1 bandolier | 12 rounds of ammunition |
| 1 „ boots | back pads (tropics only) | in haversack. |
| 1 „ spurs | curtain to helmet (tropics only) | |

2. *On the Horse.*

| <i>Off Wallet.</i> | <i>Near Wallet.</i> |
|------------------------|----------------------|
| 1 shirt | brush polishing |
| 1 towel | curry-comb |
| 1 piece of soap | rubber and sponge |
| 10 rounds ammunition | box of grease |
| knife, fork, and spoon | 10 rounds ammunition |
| tobacco | cleaning things |
| | 1 pair socks |
| | 1 forage cap. |

3. *In Cleaning Bag.*¹

| | |
|-----------------|----------------|
| 1 pair trousers | 1 pair drawers |
| 1 „ socks | housewife |
| 1 „ boots | hold-all. |

4. *In Kit Bag.*

| | |
|-----------------|-----------------|
| 1 kharkee coat | 1 flannel shirt |
| 1 pair trousers | 1 „ belt |
| 1 „ boots | 1 towel. |

Saddlery.

Every mounted infantry soldier should be in possession of the following articles of saddlery:—

| | |
|------------------------------|--------------------------------|
| Head collar | stirrup irons and leathers (2) |
| bridoon | shoe-case and straps (2) |
| bit and reins | crupper |
| head-rope | surcingle |
| saddle, with panels complete | girth |
| breast-plate and strap | numnah |
| pair wallets and straps (3) | |

¹ This cleaning bag will be carried in the kit bag, except specially ordered.

The above instructions were published for the 2nd Batt. Mounted Infantry, raised in March, 1885, at Cairo, for service with the Suakin Expedition, and are here inserted as a specimen.

APPENDIX II.

1ST BATT. MOUNTED INFANTRY VOLUNTEERS (SOUTH OF ENGLAND MOUNTED RIFLES).

Commanding Officer.....
 2nd in command
 Adjutant
 Quartermaster

A or Devon Company. O.C.

| | | | | |
|--------------|----------------|-------------|------|----------------|
| 1st Division | 1st Vol. Batt. | Devon Regt. | .... | Exeter. |
| 2nd | „ 2nd | „ „ | .... | Plymouth. |
| 3rd | „ 4th | „ „ | .... | Barnstaple. |
| 4th | „ 5th | „ „ | .... | Newton Abbott. |

B or Surrey Company. O.C.

| | | | | |
|--------------|----------------|-------------------------------|-------|------------------|
| 1st Division | 1st Vol. Batt. | The Queen's (W. Surrey) Regt. | ..... | Croydon. |
| 2nd Division | 2nd Vol. Batt. | The Queen's (W. Surrey) Regt. | ..... | Reigate. |
| 3rd Division | 3rd Vol. Batt. | E. Surrey Regt. (6th Surrey) | ..... | Kingston. |
| 4th Division | 4th Vol. Batt. | E. Surrey Regt. (7th Surrey) | ..... | Kennington Lane. |

C or Kent Company. O.C.

| | | | | |
|--------------|----------------|---------------------------|-------|-------------|
| 1st Division | 1st Vol. Batt. | E. Kent Regt. (The Buffs) | ..... | Canterbury. |
| 2nd | „ 2nd | „ „ „ „ | ..... | Cranbrook. |
| 3rd | „ 1st | Royal W. Kent Regt. | .. | Tunbridge. |
| 4th | „ 2nd | „ „ „ „ | .. | Blackheath. |

D or Sussex and Hampshire Company. O.C.

| | | | | |
|--------------|----------------|-----------------|----|--------------|
| 1st Division | 1st Vol. Batt. | R. Sussex Regt. | .. | Brighton. |
| 2nd | „ 2nd | „ „ „ „ | .. | Worthing. |
| 3rd | „ 1st | Hampshire Regt. | .. | Winchester. |
| 4th | „ 2nd | „ „ „ „ | .. | Southampton. |

Strength—

| | |
|----------------|-----|
| Officers..... | 26 |
| N.C.O. and men | 504 |
| Horses..... | 515 |

2ND BATT. MOUNTED INFANTRY VOLUNTEERS (NORTH OF ENGLAND MOUNTED RIFLES).

Commanding Officer.....
2nd in command
Adjutant
Quartermaster

A or Lancashire Company. O.C.

| | |
|--|---------------------------------|
| 1st Division 1st Vol. Batt. The King's (Liver- pool) Regt..... | Liverpool. |
| 2nd Division 2nd Vol. Batt. The King's (Liverpool) Regt.(5th Lancashire)..... | { Prince's Park, Liverpool. |
| 3rd Division 1st Vol. Batt. The Manchester Regt.(4th Lancashire)..... | { Fennel Street, Manchester. |
| 4th Division 2nd Vol. Batt. The Manchester Regt. (5th Lancashire)..... | { Hulme, Man- chester. |

B or Cheshire Company. O.C.

| | |
|---|-------------|
| 1st Division 1st Vol. Batt. The Cheshire Regt. .. | Birkenhead. |
| 2nd ,, 2nd ,, ,, ,, .. | Chester. |
| 3rd ,, 4th ,, ,, ,, .. | Stockport. |
| 4th ,, 5th ,, ,, ,, .. | Congleton. |

C or Yorkshire Company. O.C.

| | |
|---|----------------|
| 1st Division 1st Vol. Batt. W. Yorkshire Regt. | York. |
| 2nd ,, 1st ,, E. ,, ,, | Hull. |
| 3rd ,, 1st ,, Prince of Wales' Own Yorkshire Regt..... | Northallerton. |
| 4th Division 2nd Vol. Batt. Duke of Wellington's W. Riding Regt..... | Huddersfield. |

D or Durham Company. O.C.

| | |
|--|--------------------|
| 1st Division 1st Vol. Batt. Durham L.I. .. | Stockton-on-Tees. |
| 2nd ,, 2nd ,, ,, ,, .. | Bishop Auckland. |
| 3rd ,, 4th ,, ,, ,, .. | Chester-le-Street. |
| 4th ,, 5th ,, ,, ,, .. | Gateshead. |

Strength—

| | |
|----------------|-----|
| Officers..... | 26 |
| N.C.O. and men | 504 |
| Horses | 515 |

3RD BATT. MOUNTED INFANTRY VOLUNTEERS (THE LONDON MOUNTED RIFLES).

Commanding Officer.....
2nd in command
Adjutant
Quartermaster

A Company. O.C.

| | |
|---|------------------|
| 1st Division 1st Vol. Batt. King's Royal Rifle Corps (2nd Middlesex) | Walham Green. |
| 2nd Division 3rd Vol. Batt. King's Royal Rifle Corps (5th Middlesex) | St. John's Wood. |
| 3rd Division 4th Vol. Batt. King's Royal Rifle Corps (6th Middlesex) | Regent Street. |
| 4th Division 5th Vol. Batt. King's Royal Rifle Corps (12th Middlesex) | Somerset House. |

B Company. O.C.

| | |
|---|--------------------|
| 1st Division 6th Vol. Batt. King's Royal Rifle Corps (13th Middlesex) | Westminster. |
| 2nd Division 7th Vol. Batt. King's Royal Rifle Corps (21st Middlesex) | Pentonville. |
| 3rd Division 9th Vol. Batt. King's Royal Rifle Corps (1st London) | Finsbury Row. |
| 4th Division 11th Vol. Batt. King's Royal Rifle Corps (3rd London) | Farringdon Street. |

C Company. O.C.

| | |
|---|-----------------------|
| 1st Division 1st Vol. Batt. Rifle Brigade (London Scottish) | Adam Street, Adelphi. |
| 2nd Division 2nd Vol. Batt. Rifle Brigade (14th Middlesex) Inns of Court | Lincoln's Inn. |
| 3rd Division 3rd Vol. Batt. Rifle Brigade (15th Middlesex) Customs and Docks | Custom House. |
| 4th Division 4th Vol. Batt. Rifle Brigade (16th Middlesex) London Irish | King William Street. |

D Company. O.C.

| | |
|--|----------------------|
| 1st Division 7th Vol. Batt. Rifle Brigade (20th Middlesex) Artists | |
| 2nd Division 8th Vol. Batt. Rifle Brigade (24th Middlesex) | General Post Office. |
| 3rd Division 9th Vol. Batt. Rifle Brigade (1st Tower Hamlets) | City Road. |
| 4th Division 10th Vol. Batt. Rifle Brigade (2nd Tower Hamlets) | Whitechapel Road. |

Strength—

| | |
|----------------|-----|
| Officers..... | 26 |
| N.C.O. and men | 504 |
| Horses..... | 515 |

4TH BATT. MOUNTED INFANTRY VOLUNTEERS (SCOTCH MOUNTED RIFLES).

| |
|-------------------------|
| Commanding Officer..... |
| 2nd in command |
| Adjutant |
| Quartermaster |

A or Argyll and Sutherland Highlanders Company. O.C.
 1st Division 1st Vol. Batt. Arg. and S. High-landers (1st Renfrew) Greenock.
 2nd Division 4th Vol. Batt. Arg. and S. High-landers (1st Stirling)..... Stirling.
 3rd Division 5th Vol. Batt. Arg. and S. High-landers (1st Argyll) Dunoon.
 4th Division 6th Vol. Batt. Arg. and S. High-landers (1st Dumbarton) Helensburgh.

B or The Lanark Company. O.C.
 1st Division 1st Vol. Batt. Cameronians { W. George Street,
 (1st Lanark) Glasgow.
 2nd Division 2nd Vol. Batt. Cameronians {
 (2nd Lanark) Hamilton.
 3rd Division 2nd Vol. Batt. Highland L.I. (6th Lanark) Overnewtown.
 4th Division 3rd Vol. Batt. Highland L.I. (8th Lanark) { London Street,
 Glasgow.

C or The Lothian Company. O.C.
 1st Division 1st Vol. Batt. Royal Scots Edinburgh.
 2nd „ 1st „ „ „ „
 3rd „ 2nd „ „ „ (1st Mid-lothian) Leith.
 4th Division 3rd Vol. Batt. Royal Scots (2nd Mid-lothian) Penicuick.

D or The Gordon Company. O.C.
 1st Division 1st Vol. Batt. Gordon Highlanders .. Aberdeen.
 2nd „ 3rd „ „ „ .. Peterhead.
 3rd „ 4th „ „ „ .. Aberdeen.
 4th „ 5th „ „ „
 (Deeside Highlanders) Banchory.

Strength—

Officers..... 26
 N.C.O. and men 504
 Horses 515

APPENDIX III.

| Establishment of | Officers. | Sergeants. | Corporals. | Privates. | Horses. | | Remarks. |
|-------------------|-----------|------------|------------|-----------|------------|----------|-------------------------|
| | | | | | Officers'. | Troop. | |
| One division..... | 1 | 1 | 1 | 25 1 | 2 .. | 27 .. | Officer's ser- vant. |

| Establishment of company. | Officers. | Company ser-geant-major. | Sergeant riding instructor. | Farrier. | Shoeing smiths. | Saddlers. | Sergeants. | Corporals. | Buglers. | Privates. | Horses. | | Remarks. | | |
|---|-----------|--------------------------|-----------------------------|---------------------------|-------------------------------|-----------|-----------------|------------|------------|------------|------------|-----------|---|--------|--|
| | | | | | | | | | | | Officers'. | Troop. | | | |
| One company of four divisions | 5* | 1 | 1 | 1 | 2 | 2 | 4 | 4 | 2 | 105† | 10 | 114 | * Including Officer commanding company. † Including five Officers' servants. | | |
| | | | | | | | | | | | | | | | |
| Establishment of one battalion. | Officers. | Sergeant-major. | Staff sergeants. | Company ser-geants-major. | Sergeants riding instructors. | Farriers. | Shoeing smiths. | Saddlers. | Sergeants. | Corporals. | Buglers. | Privates. | Horses. | | Remarks. |
| | | | | | | | | | | | | | Officers'. | Troop. | |
| Commanding Officer..... 2nd in Command | 6 | 1 | 3* | .. | .. | .. | .. | .. | .. | .. | .. | 12 | 4 | 4 | { * Orderly - room clerk, quartermaster sergeant, and farrier major. |
| | | | | | | | | | | | | | 3 | 2 | |
| | | | | | | | | | | | | | 2 | 2 | |
| | | | | | | | | | | | | | 2 | 2 | |
| | | | | | | | | | | | | | 2 | 2 | |
| | | | | | | | | | | | | | 2 | 2 | |
| | | | | | | | | | | | | | 2 | 2 | |
| 40 | 456 | | | | | | | | | | | | | | |
| Five companies | 55 | 460 | | | | | | | | | | | | | |
| Total | 26 | 1 | 3 | 4 | 4 | 4 | 8 | 8 | 16 | 16 | 8 | 432 | | | |

| Establishment of brigade. | Officers. | Warrant officers. | Staff clerks. | Sergeants.* | Rank and file. | Horses. | | Remarks. |
|----------------------------|-----------|-------------------|---------------|-------------|----------------|-----------|--------|--|
| | | | | | | Officers. | Troop. | |
| Colonel of the Staff | 4 | .. | 2 | .. | 8 | 4 | 2 | * Including company sergeant farriers and riding instructors. |
| Orderly Officer | | | | | | 2 | | |
| Brigade Major | | | | | | 2 | | |
| Paymaster | | | | | | 1 | | |
| Four battalions | 104 | 4 | .. | 124 | 1,888 | 220 | 1,840 | |
| Total..... | 108 | 4 | 2 | 124 | 1,896 | 229 | 1,842 | |

APPENDIX IV.

SCHEDULE showing Horses, Mules, and Camels obtainable in Syria, &c.

| Animal. | Average height. | Average price. | | Rates of hire per diem. | Weight carried. | Average distance per diem. | Number procurable. | Best points of concentration. | Ports of embarkation. | Remarks. |
|---------------------|-----------------|----------------|-----------|-------------------------|-----------------|------------------------------------|--------------------|-------------------------------|-----------------------|--|
| | | Owners. | Dealers. | | | | | | | |
| <i>Horses.</i> | hands. | £ | £ | piastres. | | | | | | |
| Class A | 14 | from 40 to 300 | 40 to 300 | .. | .. | .. | .. | .. | .. | These are high bred Arab horses, and their exportation as "Chevaux de Race" is prohibited by the Turkish Government. |
| Class B | 14.1 to 15 | 22 | 25 | 15 to 20 per diem. | .. | 8 or 10 hours at 3 miles per hour. | 500 in 30 days. | Damascus, Aleppo. | Beyrout, Latakia. | This horse is strong and hardy, bred by half-bred Arab sires, out of country bred mares, having a strain of Cossack. |
| Class C | 13.3 to 14.1 | 20 | 23 | " | .. | " | " | " | " | This horse has more Arab blood than Class B, and has greater powers of endurance for slow work. |
| Class D | 13.1 to 14 | 14 | 20 | .. | 300 lbs. | " | 1000 in 2 months. | Adalia, Adana. | Adalia, Mersina. | A common bred but strong stout pony; mainly bred in Karamania. |
| <i>Mules.</i> | | | | | | | | | | |
| 1st Class | 14 and upwards | 23 | 26 | 15 to 20 per diem. | 350 lbs. | " | 500 in 30 days. | Marash, Aleppo, Damascus. | Latakia, Beyrout. | |
| 2nd Class | less than 14 | 18 | 24 | " | 200 lbs. | " | | | | |

N.B.—A large number of horses could be procured from Tripoli and exported at Ben Ghazi, but they are not to be recommended as compared with the above breeds. The Tripoli horse, though well crested, has bad loins, and shows little Arab blood. Price 12*l.* to 15*l.* approx.

APPENDIX V.

CANADIAN HORSES.

Broncho Horses.—These horses, bred on the slopes of the Rocky Mountains or upon the prairies at their base, are strong, powerful, and most hardy animals. What they lack in speed they gain in endurance, and where an English horse would die, these Broncho horses would thrive. The vicissitudes of the climate in the North-West Provinces of Canada makes these alike indifferent to the cold of Siberia or the heat of Africa.

Height 15·2 to 16 hands.

Age 4 years and upwards.

Geldings or Mares.

Prices at Calgary given by Government for

North-West Frontier Mounted Police . . . £20

Railway expenses to Quebec 3.

Ship expenses to Liverpool 5

Total . . . £28

Toronto Horses.—A veterinary Officer of experience in the Canadian Service, and a well-known Officer of Canadian Cavalry, give their opinion that a large supply of most excellent horses can be purchased in Upper Canada suitable in every respect for cavalry purposes. It was on horses of this description that the 13th Hussars were mounted when quartered in Canada.

Age 4 years.

Height . . . 15·2 and upwards.

Geldings.

Price £30 to £35 delivered at Quebec

Quebec to Liverpool 5

£35 to £40.

The facilities for breeding in Canada are so great that if once the demand were created for any one especial class of horse, the supply would in a very short time meet it, and the market price remain such as at present.

Comparative Table.

English cavalry remount—

Average price 3 years old £40

Keep to 1 year 15

Price of 4 years old £55

Broncho horse—

4 year old delivered in England . . . £28 to £32

Toronto or Upper Canada Horse . . . £35 to £40

The CHAIRMAN: In inviting you to discuss this paper, I would express the hope that some of the cavalry Officers who are here to-day will give us their views upon this subject, because I cannot help thinking that the lecturer has dealt with it almost exclusively from an infantry point of view.

Lieut.-General Sir EDWARD HAMLEY: My lord, ladies, and gentlemen, my friend Major Hutton has done me the favour to invite me to be present on this occasion, and as it appears to me that his proposals are extremely far reaching, going quite beyond the immediate occasion, for they extend far into our military system, I think it is the duty of anybody who has formed any opinion upon this subject to express it. Major Hutton's proposals are of two kinds: the one is a proposal for procuring an improvised force—small bodies—for an emergency; and the other is to create a considerable corps of mounted riflemen such as would be of importance in a campaign and on a field of battle. He tells us that "some military authorities have advocated a permanent corps of mounted infantry. I venture to submit that this would entirely defeat its own object. Organized during peace, and acting with cavalry, it would be impossible to prevent such a force becoming a very indifferent cavalry." I confess I think Major Hutton has treated those whom he calls military authorities rather cavalierly when he disposes of their views, formed after much consideration, in such a summary manner. It appears to me that this idea of his that they would form a very indifferent cavalry is an idea entirely of his own imagination, founded upon nothing; I will therefore, if I may without offence, venture to call it a baseless assumption. And when he says, "An infantry soldier would under these circumstances soon lose his identity as such, the temptations to become a cavalry soldier would prove too strong," I ask myself is it possible that I hear a British Officer talking of an arm to be created in Her Majesty's Service? What sort of soldiers would these be who being intended for one purpose convert themselves to another? What sort of soldiers would they be who, being intended to become mounted riflemen, make themselves into indifferent cavalry? What would their Officers be about? What would the Inspecting Generals be about who permitted it? And, lastly, what would the authorities be about who, intending to form a corps of mounted riflemen, found that they had only got indifferent cavalry? If such a thing were possible I should hope that the nation would ask the reason why, when soldiers and Officers, Generals and authorities, would all be involved in the same condemnation. I have not the slightest doubt that if the country sincerely and seriously sets about getting itself a corps of mounted riflemen it will get what it wants, and having got it, in my opinion it will have got a force of infinite value, such a force as, if it were in preponderating numbers on the battle-field, might well turn the scale of victory. Major Hutton proposes to get these corps of riflemen from the Volunteers. Now I see a very eminent Volunteer Colonel present, Colonel Macdonald, and I speak in his presence with some diffidence, but nevertheless I see two very important objections to procuring these forces from the Volunteers. The first objection is that the Volunteers are a special force created for home defence. They are to pursue their duties as citizens till they shall be called upon as soldiers to defend the country against invasion. But to call upon the Volunteers to form a force which is to hold itself ready at any moment to go to Aldershot for a fortnight, and then proceed to some distant and foreign theatre of war, is to introduce an entirely new element into the Volunteers, and one which I take the liberty of thinking should not be introduced without very considerable hesitation. That is one objection, and the other is this: the Volunteers are a force that I have a very high opinion of, and I have no doubt that under a proper system, which they have not quite got yet, they will make most valuable troops for home defence, and will be fit to encounter any kind of invader. But what is this you are asking them to do? Volunteers taken from the ordinary regiments are to go to Aldershot for a fortnight, and then they are to proceed to a foreign country to meet what? to meet the trained soldiers of the Great Powers of the Continent. Now I ask is it reasonable to suppose that a body of Volunteers called upon in this way should be fit to undertake at once the most arduous duties which any infantry can be called upon to perform? For remember the duties of mounted riflemen will be very peculiar, very arduous. They will be called upon in emergencies to place themselves in positions where they must be ready to meet any

kind of troops or any combination of troops, and you are about to call upon Volunteers to do that with the trained Continental armies for opponents. I say that to do that would be to invite disaster. So far, then, as to one part of his proposal, that of creating a large force of mounted riflemen and raising it from the Volunteers. The other proposal is to improvise small bodies for emergencies, and Major Hutton tells us what he thinks would be the best way of doing it; and that best way is to take detachments from our infantry regiments. Now I suppose that every soldier in this room has been brought up to believe in our regimental system, to believe that it is something so valuable as to be almost sacred. He has been taught to believe that the units (that is to say, battalions), the individuals of which know each other, live together as comrades, are trained together, know their own Officers, and thereby learn mutual reliance and confidence in each other, form a kind of force which would resist the stress of the battle-field better than those drawn from any other source whatsoever. But I ask what becomes of this idea if our regimental system is to be made ducks and drakes of in this way—if it is to be a mere playground for Major Hutton to disport himself on when he wants to create, on an emergency, a force of mounted riflemen? But I need not pursue the subject by saying what I think myself about it, because we have Major Hutton's own ideas on the matter very well expressed. He has told us what he thinks about it. He says: "The principle of taking detachments from regiments on service for this duty should never if possible be resorted to. You extract, in so doing, from each company in an infantry battalion the four or five best soldiers and leading spirits, men whose example and moral influence among the many young soldiers of our battalions is simply invaluable. Such a principle is vicious in the extreme, and one against which every good Commanding Officer kicks." It is the very system which he has condemned in these terms which he is about to apply to all the regiments apparently in the Service. He is going to draw freely upon them according to his system, and he is going to make every good Commanding Officer in the Service "kick." And to complete the inconsistency, he tells us that in his matured scheme, which is to be a permanent institution, he is going to prepare the regiments next for foreign service to be drawn upon in this fashion, so that actually the very regiments upon which this would fall, are the regiments he has just described as being exposed to all kinds of calamities, if that measure should be carried out in them. Now this appears to me to be an inconsistency which Major Hutton will certainly have to explain. I for my part hold to the belief in the regimental system. I do not believe at all in the idea of making an infantry soldier into a cavalry soldier one day and a cavalry soldier into an infantry soldier the next, thereby creating a sort of transformation scene, which appears to me more appropriate to a Christmas pantomime than to the British or any other Army. It may be said, "If you won't have this, what do you recommend?" Now I am most anxious to impress on you that it is exceedingly desirable and expedient to have a force of mounted riflemen. I would not create that force by disorganizing anything, but by organizing something. As Major Hutton tells us the country is too poor to furnish an additional regiment of any kind, I would begin by making one of our infantry regiments into a regiment of mounted rifles; they should be equipped and horsed for that express purpose and no other; they should be trained entirely to act as infantry and nothing else, never be allowed to engage in any other formation than that of infantry; they should have no cavalry arms; they should have a pure infantry equipment, with such addition as would enable them to ride comfortably; and as for their horses, we ought not to think of mounting them on cavalry horses, but on good serviceable ponies, such as you might buy perhaps on an average at 20*l.*, and which would do a great deal more work in a campaign with light men on their backs than horses of the size of those of our cavalry. Men trained and equipped in that fashion could not possibly pretend to become cavalry. How could they? They would be what you want them to be; they would be mounted riflemen; and if you could show a good serviceable battalion of that kind, well trained, in operation at Aldershot and elsewhere, so that people might see it, I think the public is not so stupid but that it would be convinced of its value, and possibly would have no objection to supply the necessary means for augmenting such a force. I have been exceedingly sorry to differ from my friend Major Hutton, but really I could not help it. I am perfectly well

acquainted with Major Hutton's value as an Officer, and I am quite sure he has been actuated by nothing but zeal for the Service in bringing these proposals before us. But then you see Major Hutton has had an interest already in creating a force of this kind, and, like all of us when in pursuit of an idea, his idea has perhaps become a hobby, and the career of his hobby has led him very far indeed—led him to make inroads on the organized system of the British Army, which I venture to think is a matter of infinitely more importance than that of procuring a small body of mounted infantry. If I were not already aware of Major Hutton's merits, we have here Sir Archibald Alison, the value of whose testimony cannot be surpassed, and who I am sure will say everything in the world in favour of his old follower. Therefore, in the hope that Major Hutton will forgive me for having differed from him, in consideration of the magnitude of the interests involved, I will now conclude my remarks.

Lieut.-General Sir ARCHIBALD ALISON: My lords, ladies, and gentlemen, I have listened with very great interest both to the lecture delivered by Major Hutton, and to the remarks of Sir Edward Hamley. I am sorry to say that I cannot quite agree with Sir Edward Hamley in the view which he takes as to the possibility of organizing a permanent corps of mounted infantry. There is no age almost in which we cannot trace an attempt to create such a force, and I do not remember one single instance in which it has been successful. Our dragoon regiments were formed for this object and for no other. The dragoon regiments in all foreign nations have, I believe, their origin in precisely the same want, and they have all ended in the same way. They have practically become simply regiments of cavalry. As far as I can judge you cannot keep a corps of mounted riflemen permanently embodied without their degenerating into bad cavalry. But I do think that you can get such a corps together for a campaign which will do right good service, if you have in your infantry battalions men previously trained to such a knowledge of horses and of riding as will enable them to keep their horses in condition, and to move at a fairly quick pace on them. I will give you an example of how this works, one which came under my own personal observation. I had once to land at Alexandria with a couple of battalions. I had no guns; I had no mounted men; I was in the face of a large force of the enemy outside the walls, and the walls had breaches in them through which a whole battalion could march. In such circumstances it was absolutely necessary to get some outpost system established which could give us timely notice of the movements of the enemy. As we were marching up from the landing place through the still smoking streets, Major Hutton told me that there were in the ranks of the battalions which I had there, men who had been previously trained as mounted infantry. Marching along we called for volunteers. I sent an Officer to the Khedive, to see if he could get some horses. I got both the volunteers and the horses that night. The next morning a detachment of these men paraded before me at 11 o'clock, and went out to begin the outpost duties of the force. They never lost touch of the enemy from that time until they marched into Cairo with the cavalry brigade, under Sir Drury Lowe, except during the short period when they were passing by sea from Alexandria to Ismaïlia. I never heard of a single instance during that campaign in which the duty entrusted to those men was not well and thoroughly performed. I think this shows what you can do with infantry when they have got that slight previous knowledge of horse duties which is absolutely necessary. But you must never imagine that mounted infantry can do the duty of cavalry. That is quite impossible. The highly trained cavalry man will always be infinitely superior for cavalry work to a mounted infantry man. You have two difficulties with regard to mounted infantry. On the one hand you must not expect that you can at any moment put an infantry man on horseback, and without any previous training transform him into a good mounted infantry soldier. On the other, you must remember that if you raise a corps of mounted infantry and keep it permanently embodied, you will soon find it degenerate into bad cavalry. The only way out of it at all, that I can see, is that you should have a certain number of men in most battalions at home put through, as opportunity offers, a mounted infantry school, to give them that small amount of horse knowledge which is necessary, and which can be done in three months. They will then be ready for this service if ever wanted. I think it advisable

that this should be done, especially with regiments going to the Colonies. In India it is not of so much consequence, because there, with our large amount of excellent native cavalry, we do not require mounted infantry in the same degree. But in our Colonies we seldom have cavalry, and we are almost helpless if we have not some mounted men for outpost work and quick movements. I consider it an immense advantage that every battalion should have in its ranks a small body of men able to move with the rapidity of cavalry, and possessing the steadiness and fire power of infantry. With regard to a European war it seems a doubtful point whether it might not be advisable, instead of taking detachments from several battalions and uniting them into a provisional one, to pick out a few battalions, eliminate from them all men not suited for mounted work, and put them through the short amount of training necessary. I think it an open question whether this might not be a better system than the only other alternative, which is to take selected detachments from battalions not in the first two Army Corps. The choice lies between these two. The views that Major Hutton has expressed with regard to mounted infantry and their use I entirely endorse, in so far as the regular forces are concerned. In conclusion, I would only add that I do not think it possible either to make mounted infantry take the place of cavalry, or to create such a force at once by taking men from infantry battalions who have had no previous training in riding and the management of horses.

Major-Gen. Sir REDVERS BULLER: Sir Edward Hamley criticized Major Hutton's paper from a general, and I may say a very outside view. I wish to offer one or two criticisms rather on matters of detail. I fancy that the Chairman has foreseen one point, in which I somewhat object to Major Hutton's proposals, as he specially invited mounted cavalry Officers to give their opinions upon the paper. It has occurred to me in listening to his valuable and well thought-out paper, that Major Hutton is a little inclined to be too hard on the cavalry; he rather seems to me to wish that the mounted infantry shall, so to speak, "skin the lamb;" they are to have all the fun, and it is not quite clear what is to be left to the cavalry to do. He gives as the first, and I assume he means the most important, object of mounted infantry, "to provide an improvised substitute for an organized cavalry on small and hastily organized expeditions." Now I cannot help thinking that in the English Army we really do a great deal of injury to our cavalry by the use we make of mounted infantry, for in the late small expeditions, the cavalry to a great extent have been kept away, and have lost the experience that was their share. It has been said, "We will use mounted infantry instead of cavalry." As Major Hutton shows, mounted infantry can only be proved to be cheaper by accepting a worse article. He says the mounted infantry at Suakin were cheaper than the cavalry, but he puts them on worse horses, and therefore estimates for a worse article. I was also at Suakin in 1884, though on a different occasion to that which Major Hutton refers to. We had, fortunately I think, two regiments of cavalry and a very small force of mounted infantry. I believe that no cavalry work of late years in the English Army has been better done than the way in which those two regiments of cavalry, the 19th and the 10th Hussars, took Sir Gerald Graham's force into Tamanieb. I do not believe that any mounted infantry could have done better, and mounted infantry would not have had the value of cavalry, and could not, had they been so required, have been used as such. I think we should hesitate before we accept the statement that mounted infantry are either to replace or supplement our cavalry. I cannot help thinking that we should approach this question more fairly, if we merely dealt with the value of mounted infantry as mounted infantry by itself, and I would in this connection say—and I have heard a good many Officers whose opinions I value say the same thing—that I believe that, as in the last great war, the value of cavalry was very much more fully recognized, so in the next great war will the value of mounted infantry be the most noticeable feature. I believe that the reason that the Germans made so little use of mounted infantry during the French war was because the French Army had been rendered almost entirely immobile by the loss of their field army, either at Sedan or in their large fortresses, and that had the French been more enterprising we should have heard more of German mounted infantry. The second exception I wish to take to Major Hutton's remarks is, that I think he overlooks the absolute necessity that

exists for a mounted infantryman being drilled as an infantry soldier, and as nothing else. I do not think that in any way any cavalry tactics or duties should enter into his drill, and I think when Major Hutton says that in the school that he proposes the men can be taught "the very simple principles of a mounted infantry man's work," he slurs over or joins together two separate subjects, viz., infantry drill, stable management, and riding. I hope if the school ever is started, the mounted infantryman will be taught nothing but the care of his horse, and how to ride it, and that he will learn his drill in his own regiment on foot. It once occurred to me to command a large force of mounted infantry, and almost from the first I found it was impossible to use the same portions of the force for both duties, those which were quasi cavalry and those which were entirely infantry. Almost the first thing I had to do was to set apart a certain number of men, to be used only for scouting and reconnaissance, and what I may call cavalry work, and the remainder were the fighting men to act as infantry, as I found that it was practically impossible to train men to combine the two duties satisfactorily, and that to get the full value out of mounted infantry, the men must always be treated tactically, merely as infantry soldiers provided with a means of rapid locomotion. These are, I think, the only points on which I have to express any dissent from Major Hutton's views.

Colonel Lord WANTAGE: My lord, I feel great diffidence in even saying the few words that I propose to say in the presence of such masters of the craft as those who have addressed this meeting, but I feel that I should not be doing what I think right if I did not thank Major Hutton for bringing this very important question before this Institution. My lord, I remember that in a motion on this subject which I brought before the House of Commons in 1881 I quoted some remarks of yours which occurred in the Wellington Prize Essay, which you wrote in 1871, in which you expressed this opinion, that whoever was the General of the future, if he concurred with the writer of the essay, he would at all events take care to have himself well supplied with mounted infantry in the case of a campaign. It was your fortune to develop the policy of that essay during the Egyptian campaign. I must say that although the highest authorities have agreed on the advantages which an army is to gain from an extension of mounted infantry, it does seem to me surprising how little advance has been made in it during all these years. I would now especially allude to the Volunteers, and here I must at once enter my protest against Sir Edward Hamley's remarks against training Volunteers as mounted infantry. He says that it would not be reasonable that Volunteers should be put to so great an ordeal, and he goes on to say that it would absolutely be courting disaster. Well, now, in my opinion, if there is an aptitude for which British subjects are peculiarly fitted it is the aptitude of the managing of a horse and using a rifle. It is a very extraordinary thing that although you might suppose our Volunteers might make the finest mounted infantry in the world, at the present time we have only forty men who are trained as mounted infantry. Let me make this remark on what Sir Edward Hamley said. He said that "to withdraw the Volunteers from acting as the defenders of their country would be a mistake." Now there are two distinct and separate advantages which the country derives from the Volunteer Force. They seem to be quite apart; the one is the certainty which under Providence we may claim of protecting this country against invasion, and the other is the advantages which the Volunteer Force affords for educating and training the people to be citizen soldiers, through our Volunteer Officers, and through the permanent staff, including the Adjutants, of whom I always speak with the greatest respect. I think more might be done to develop the Volunteer Force as a training establishment than has yet been done, I mean in training the youth of the country in military exercises. The Volunteers send into civil life about 40,000 men every year trained as soldiers. They might go further and train a proportion of these men as mounted infantry, and I do not know a mode in which better service to the country might be done than by so training men for that particular force. It is a service congenial to the tastes of the people. I know Volunteers would like to have the opportunity of being taught as mounted infantry. A great European war is not an impossibility. If there be a war, I suppose England might place at once two corps d'armée of regular soldiers in the field.

But we should have to expand our Army beyond that, and how are we going to expand? There are many ways of expanding I dare say, but I know one way in which you might expand very readily. You might go into market, and offer to enlist men who have been trained as Volunteers, and in that way you might have a vast number of men who would come to your ranks. The more your civil population is trained the better, and the more men are trained as mounted infantry the better. This enlistment may take place without in the slightest degree interfering with the constitution of the Volunteer Force. I know that my noble friend (Lord Wemyss) has been always jealous of Volunteers being called upon for anything except to defend their country, and I agree with him, but I see no reason why Volunteers should not lay aside the Volunteer uniform and enlist as soldiers for a campaign for six months or a year, or whatever the period may be. The Volunteer corps which would be most acceptable would be corps of mounted infantry, and were I young enough I would like to take part in the glorious deeds reserved for such troops. We have done nothing to teach our Volunteers mounted infantry work, and this is a thousand pities. Secretaries of State have shown the cold shoulder to the development of the Volunteer Force. In this direction Officers have asked to be allowed to form Volunteer mounted infantry, and the reply has been, "We are afraid the Yeomanry would dislike it," and "You will interfere with the Yeomanry." The Yeomanry can take care of themselves; they are better paid than the Volunteers, and if they cannot take care of themselves I am afraid there is nobody can. There is no reason why Volunteers should not run *pari passu* with the Yeomanry. Major Hutton asks that mounted Volunteers should be paid on the same scale as the Yeomanry, but I know Volunteers won't get that. The financial condition of the country is such that you will not get that. I do not know that we shall get anything extra, but if we only had the loan of some equipment and saddles free of cost we could at all events train some of our men, and it would be some help to us. If that were done, when an Inspecting Officer came down, he might say "he would like to see some of the men who have been trained at our ranges under our own staff act as mounted infantry." But when accoutrements have been lent to Volunteers, as in my own case, we have had to pay for the things, although they were partly used. I cannot see any reason why they should not be lent to Volunteers who, at all events, are doing their utmost in the public service. I do not suppose that a word need be said to show the advantage of these mounted infantry. If I might compare a battle-field with a chessboard, I might say that supposing, at a critical period in the game, one of the players was permitted to turn two or three of his pawns into knights, supposing the players to be equal in skill, who can doubt which player would have the best of the game? It really amounts to this, that a longer reach is given to your infantry. I do not desire that infantry should have anything except the opportunity of getting more rapidly from one place to another, more rapidly than infantry soldiers can do. You double and treble the rapidity with which soldiers can move, and you, in an equal proportion, increase the amount of ground over which they can travel. I am speaking now of Volunteers, I say nothing about the regulars. Distinguished military men are now taking this question up. If they wish to see it developed in the regular service I have no doubt they will attend to it; but I do hope that in the Volunteer Force there will be an effort made to advance this most useful arm.

Colonel J. H. MACDONALD: Speaking as a Volunteer Officer, I can most thoroughly corroborate what has just been said by Lord Wantage. So far from its being the fact that the authorities are encouraging this movement, they have put an absolute stop to the enrolment of any men as mounted infantry in the Volunteer Force at present. I have the satisfaction myself of being the last Commanding Officer who had permission to have some mounted Volunteers. I have now about eighteen or twenty mounted men in my corps, and I should be very sorry to lose them. As Lord Wantage has said, they got no encouragement; the stipulation on which I was ultimately allowed to enrol them—which I was only allowed to do because I was able to show we had made a considerable outlay already, not knowing that an order would be issued against it—was that not one sixpence of expense was to come against Her Majesty for the organization of these troops. A good deal has been said on the question as to whether the Volunteer Force would be a useful force

for the purpose of organizing mounted infantry. I thoroughly agree in what Lord Wantage has said as to the probable usefulness of the Volunteer movement and the Volunteer Force in a different direction from that which tends only to the defence of the country from invasion. But, on the other hand, I feel very strongly that to attempt to turn the Volunteers in their ordinary work in peace time into anything in the nature of a paid force would be a mistake; therefore I do not agree with the views of the lecturer that men who are to be enrolled out of the Volunteers as mounted men should receive any pay at all in time of peace.

Major HUTTON: That was not my suggestion.

Colonel MACDONALD: I am glad it is not so; I must have misunderstood. If anything is to be given to encourage the formation of mounted Volunteers it should be given in the way of providing the equipment of the force. I think it would be the greatest possible mistake to Volunteers mounted upon any kind of screws that are to be picked up, to be enrolled as mounted infantry. In my own corps I make it a distinct stipulation that every man is to provide his own horse, and for the small number required attached to each corps, I think, with the love of sport which there is in this country, there should be no difficulty at all in obtaining men with proper mounts, if only the Government would give some little encouragement in the way of meeting the necessary expenses. There is another matter which deserves consideration; it is the question whether these mounted men should be organized upon the footing of only one man for each horse, and I should like to know from the lecturer what his views are upon that subject. It seems to me that as regards mounted infantry it is a serious waste of the expansive power of horses to have say twenty horses with only twenty men to form the mounted infantry attached to a corps.¹ In a great many cases, in fact in almost all cases in which mounted infantry could be used, there is no necessity for a very high rate of speed. Your only object is to be able to move your men at a considerably more rapid rate than infantry, and therefore to be able to move round to and from posts which might not be safe for unmounted infantry to hold. Would it not be a good plan to have double the number of men to horses trained for this purpose? If men are to make a bolt of 300 or 400 yards, the man on horseback having his own rifle in his bucket or slung on his back can easily carry the other man's rifle, and the other man holding on can very well get over the 300 or 400 yards to escape from danger of capture or to take up another position. I shall be very glad to hear what the lecturer may have to say on that matter. There is one subject which has been referred to by the lecturer which I think deserves serious attention, and that is the necessity for the strictest possible drill, and not having, as is so frequently suggested by many people, a loose system of drill. It is often supposed that those who are in favour of abandoning particular forms of drill wish to have a "loose" system of drill. The whole desire of those who wish to see our system of manœuvres altered is to transfer the mechanical operations of drill to those forms which alone are useful in the field of battle. The looseness which prevails now arises in this way, that you persist in moving your men about for months and months upon parade in a mode in which they never will move in the field, and when you turn to what you call "action exercises," you immediately introduce a new system, in which you never include any careful steady attention to minutiae at all. It would be infinitely better I suggest, Sir, both for infantry and for mounted infantry, if the drill were so adapted that your stiff and steady training should be given in the same formation as your more extended and more "action exercises," if I may so call them. I think this very lecture illustrates that most admirably. Who can suppose that it would be of the slightest use for men who are to be employed as mounted infantry to be set down as infantry on foot without their horses, and taught to move about in barrack yards for weeks and weeks touching one another's elbows? When they go out with their spurs, that is a thing they will never do when dismounted. I say, then, let us move them and all infantry about in the barrack yard with intervals between the men; teach them to observe those intervals with the utmost exactitude; train them to do all that with the most perfect mechanical detail, just as you

¹ As one man is required to hold three horses, the power dismounted is only two rifles to every three horses.—J. H. A. M.

do now in the close touch formation—the shoulder to shoulder drill—and you will teach them something which will be practically useful. The old system may contain many useful details for effecting a certain amount of discipline and steadiness in the men, but it is not the kind of discipline you want, and one writer whom the lecturer quoted, M. Rogniat, uses a very just expression which is more applicable now than it ever was, when he calls upon the tacticians of his time to abandon “une abondance stérile,” a quantity of unproductive manœuvres which will effect no good result, and to confine themselves to those which, to use the words of Guibert, are “*relatives à la guerre*,” then, he says, you will get a system which, instead of worrying the souls of men, will be interesting to them, and will really train them for the business they have to do. I trust it will not be supposed that the Volunteers have any desire to affect a loose style of drill. That word “loose” is often used in a most misleading sense. We are told that when men cease to touch one another, their drill must become loose. I was delighted in this theatre some time ago to hear Sir Lumley Graham express the opinion that movement without touch was not loose drill at all; that looseness consisted in want of strictness, and that men could move just as steadily with an interval as they could with touch. And this confirms my own experience.

Colonel the Hon. PAUL METHUEN: My lord, ladies, and gentlemen, it was my fate last time I spoke in this room to speak after my friend Colonel Macdonald, and I am bound to say I differed with him in most of the arguments he then made use of. Now I wish to go back to what I think is the principal subject of this lecture. It is no use talking about what the drill is to be, till we know we are to get the men for a mounted infantry corps. We hear from those Officers who have spoken that the first thing we are not to do is to ruin the *esprit de corps*. Now there are very few will contradict me when I say, supposing even you do get the detachments from different regiments of the Service, which are composed of as good men as can be, still the detachments from the different regiments are not so good as troops forming one regiment. It is far better to have a good corps of mounted infantry than to have any number of men from different regiments, and I contend that if the Government does not see fit to give us a corps of mounted infantry for a permanency, it is perfectly impossible for us to have such a corps as I consider necessary unless you turn either to the Volunteers or recruit from the better classes in this country. When Lord Wolseley was in Egypt in October, 1884, and it was very hard indeed to find troops to do the work required, I then called upon Sir Arthur Herbert and offered to raise a corps from the Volunteers. Now Sir Edward Hamley has remarked it is not the *rôle* of the Volunteers to serve abroad. Have men from the Post Office Corps served abroad with the Army or not? What is the difference between the Post Office Corps and the remainder of the Volunteers? Surely they may equally serve abroad; and I believed when I went to Sir Arthur Herbert and asked him to allow me to raise 500 men from the Volunteer Corps, I should have had no difficulty. Although Sir Charles Warren gave me every help in raising a corps in November, I found there was very great legal difficulty in enlisting men in England. He said, “You will have to get your men from the farmers and the gentlemen about the country,” and he said, “You must get your men as quickly as you can.” Well, I got the very best men I could, and the only men who came to me, who in some cases failed eventually, were the old soldiers. There is this difference in the old soldier, he is either a very good man or a very useless man. I do not think anything you can name runs so quickly to seed as the old soldier. I had some old soldiers, you could not have had better; I had some, you could not have had worse. When the corps reached the Cape some few grumbled, but I will say this for them that, taken as a body, I never wish to serve with a better behaved lot of men. You know what twenty or thirty bad characters will do in a regiment; they show up to the damage of all good men, but from the time I left England to the time I came back I know I shall never command another 500 men who would do the work better than they did. I speak in an especial manner of the gentlemen and farmers in the corps. It is often said to me, “Your men could not ride.” Well, who has ever gone out hunting, and when you have come to a stiff fence has seen every one go over it? My experience is a large number refuse. It is very hard to find 500 men who can ride well at once, and it is

equally difficult to find men who shoot well with a rifle and are good active men all round. It is very easy to find men who are good shots at a standing target, but very hard to find good shots at moving objects who will ride their horses over a fence and are thoroughly good men all round. It is specially difficult to get men out of the Volunteers who can both ride and shoot well. I may be asked, "What do you suggest as an improvement?" Well, I would suggest a school, as Major Hutton says. It is equally difficult for a cavalry Officer or an infantry Officer to take command of a mounted infantry regiment. I had no idea until I got command of the regiment how very hard it was, and I noticed that where a cavalry Officer got the command of a regiment, without knowing it he treated the corps from a cavalry point of view, whilst I looked at it from an infantry point of view. I certainly should have commanded it much better if I had gone to a school at Aldershot. This applies to non-commissioned officers just the same. You want a man who knows a horse, and you want a man who knows infantry drill. This must be taught in the school, and therefore when you call for another regiment you should be able to provide the corps with Officers and non-commissioned officers who have been to some training school. Time is another object. You require a month or six weeks for training. I only had a fortnight, and that was a very short time. The question comes what number of men you could raise. I have not the slightest doubt that in a month or six weeks' time you might get men enough for a brigade. The Commanding Officer should have the veto of taking Officers sent him or not, because Commanding Officers do not always give precisely the stamp of Officer required. I think if we had all these advantages given to us, we could produce in that time as good a regiment or brigade as could possibly be produced in any army. I am of opinion such a regiment should not receive higher pay than the cavalry. It is a very great mistake to give men a higher pay than that received by troops serving alongside them in the field. I would not even give them a bounty or promise any gratuity, but if they did the work well you might give them a present afterwards. I am perfectly certain you have available at any moment a body of men of the very best class that the country can produce—a body of men who are ready to serve not for pay, not only to see active service, but because they know that we cannot spend our lives better than in the field in the presence of an enemy.

Major Lord MELGUND: The lecturer has referred to the possibility of drawing a certain supply of horses from Canada, and as I have not very long returned from there, it may not be out of place if I say a few words. I had occasion when Colonel Russell gave his lecture here last summer to refer to the subject, and since that time I have had a great deal of correspondence with Canada about the supply, and a good deal of information has been sent to me. There is no doubt, I think, that the supply is very large, but little seems to be known of it in this country. As to the quality of the horses it is difficult in Canada to find a badly bred horse at all. You may divide them into several different classes, those suitable for transport and those suitable for light cavalry and mounted infantry. For the transport, the horses most suitable are those crossed with Clydesdale horses and Canadian mares, and also a cross with "Percheron" horses and the Canadian mare. The "Percheron" horse is the horse that was used in the days of posting long distances in France, mottled grey, with good action, and likely to produce very good stock. As regards transport horses, any one who was on General Middleton's line of communications would have been struck by the extremely good looks of the transport horses on that line. They showed a great deal of quality, indeed it was almost impossible to find a bad one. As to cavalry horses they would be procured from a cross between thoroughbred English horses and Canadian mares, and also from the Broncho. In the north-west the horse chiefly used is the Broncho, and of all horses I have ever seen they certainly are far and away the best for light cavalry. The average height is 15'2 and 15'3. They are very hard, show a deal of breeding, and they can go for ever. They have, however, two faults which might be pitched upon, one is that they are all branded, and the other is that none of them know how to trot. The ordinary pace is called the "loup," a sort of hand canter, and they "loup" along for about fifty miles without any difficulty. I will show from a few figures what the actual supply is. In 1871, in Ontario, Quebec, and the Maritime Provinces, the total number of horses was 836,743. At the census of

1881 it was 974,292, showing an increase of 16 per cent. in those provinces, and that is leaving out Manitoba and the north-west, which, of course, it was impossible to reckon on in 1871. Since that time the supply has largely increased owing to the American duties. Formerly there used to be a very large exportation from Canada to the States, but from the strict manner in which the States authorities enforce the duties now, the Canadians do not send nearly so many horses out of the country. At the same time American agents do go frequently to Canada, and it is no rare occurrence for an American agent to buy 200 or 300 horses in ten days. I am told it would be quite possible in two months in Canada to buy 2,000 horses suitable for transport, and 1,000 suitable for cavalry purposes. The census taken in 1881 for the whole Dominion gave 857,855 horses and 201,503 colts and fillies, making a total of 1,059,358. But you will best understand the large supply that there is in Canada from this statement. Colonel Russell in his lecture last summer gave a comparison of the number of horses to the population in different countries: Russia, 235 horses to every 1,000 inhabitants; Austria, 100; France, 80; Great Britain, 84; and Italy, 25. Canada has 240 horses to every 1,000, and I think that is a pretty good proof that the supply is tolerably large. As to prices I have a great deal of correspondence, and I think it is pretty well agreed that transport horses could be delivered at Montreal at an average of from 32*l.* to 35*l.*, and cavalry horses at 32*l.* per horse. So that, I think the prices would not be high. All the estimates sent to me have been too high as to the cost of bringing horses over from Canada to this country. It has generally been reckoned at 10*l.* per head, but I am informed that in the case of larger quantities of horses, that is to say shiploads, with the present improved means of communication, and the large ships which are now especially fitted for carrying cattle, the probable cost of the sea-passage would be 3*l.* 3*s.* per head, and that they could be insured at 2*l.* a head on the prices I have named. Of course there has been a great deal of talk in Canada about the possibility of forming some sort of Government dépôt, and Major Hutton alluded to it in his lecture. There is much that is very enticing in the formation of an Imperial mounted dépôt in the ranche country, and in some ways it might be possible, but in the face of bad times here it would be extremely unpopular in this country, and on the whole I am inclined to think that at present such a plan is theoretical. But, on the other hand, it appears to me that the possibility of getting an annual supply or a large supply on an emergency is well worth considering, and if the information I have been able to give is of any use, I shall be very glad.

Colonel Sir LUMLEY GRAHAM: I should not have risen in the presence of Officers who are more able to speak upon this subject than I am if it were not for some remarks that have been made by Lord Wantage and Colonel Methuen. Those remarks applied to what Sir Edward Hamley said, and as he has left this meeting he is not able to say anything to correct the misapprehension that I think both Lord Wantage and Colonel Methuen have formed with regard to his meaning. I do not understand Sir Edward Hamley to undervalue the services of the Volunteers (he is the last man to do so): or the qualification of Volunteers as mounted infantry or the inexpediency of instructing them as such, but what I understood him particularly to find fault with was the idea of the lecturer that a large corps of mounted infantry should be formed of Volunteers for service in any Continental war. It is true the first reason Sir Edward Hamley gave against this suggestion was that he did not think the Volunteers ought to be called away from their legitimate duties at home. That objection may be answered by what Lord Wantage and Colonel Methuen said. But I think the second reason was still stronger. Sir E. Hamley said he thought it would be courting disaster to send partially trained men against the most highly trained troops in the world. I think so too; and it appears to me that this is an argument that Lord Wantage and Colonel Methuen did not seem to grapple with. Coming to the lecture itself, I find that there are two modes of employing mounted infantry mentioned. The first is to provide an improvised substitute for an expensive cavalry in our small expeditions. I have no doubt that this is necessary. It is an evil, I believe, but still it is a necessary evil. Any improvised force is only a makeshift, but if you must have an improvised force of mounted men for our small expeditions in wild countries, it is very pos-

sible that the only way of obtaining them is to get men from our infantry regiments for the purpose. I think, however, that in Colonies like the Cape of Good Hope and Natal, a local force might be organized to be used as mounted infantry in case of war with the natives. If not, I suppose the only resource we have is to employ our own infantry soldiers. Then as to the way of raising them; I quite agree with what Sir Edward Hamley said about the inexpediency of breaking up units, and that clearly discipline cannot be so well maintained in a body of troops composed of detachments from a great many different corps, and I wonder whether that is the reason that the evil alluded to by the lecturer made itself felt in the late war. We know that in the last Egyptian campaign the system of putting together detachments from different regiments was carried to a very great extreme, and we were told by the lecturer, I was very sorry to hear it, that there was a great absence of obedience, a great absence of fire discipline. I am not surprised at it under the circumstances, but I hope that the state of things described by the lecturer was exceptional; otherwise it could only be attributed to one of two causes, either to a deterioration in the English national character which I should be sorry to believe, or else to some very great want of training. The second may be partially true, but I think that probably the chief reason for the want of discipline complained of by the lecturer was the faulty organization of a large part of the force. Officers and men were excellent, no doubt, individually, and if they had not been so excellent I believe that a great disaster would have occurred; as it was, no doubt they did their work as well as, and better than, could have been expected under the circumstances. The second way in which the lecturer assumes mounted infantry to be used, namely, as a large auxiliary force for an army in European warfare, seems to me to be a mistake. I think the same objection that I mentioned just now in speaking about the employment of Volunteers for that service would apply to the employment of regular mounted infantry, not permanently organized as such (that idea seems to be generally scouted), but mounted infantry raised for the purpose on the spur of the moment, as the lecturer suggested might have been done if war had taken place last year. I think that mounted infantry thus raised, and necessarily only partially trained, would be utterly unable to cope with the trained troops of foreign armies. We must remember that two of the most warlike nations of the Continent are training their cavalry to a very great extent to fight on foot; one at least to a far greater extent than we have ever trained cavalry yet, and I venture to think that that is the solution of the question. I am not a cavalry man, so that it is not a case of "nothing like leather," but I think the real solution of the question is to increase our force of cavalry, and if it is necessary to dress it, equip, and arm it in a more practical way, so that the men should not be obliged to do what the lecturer said, run about with a topheavy busby and a clanking sabre, and that sort of thing, which would be very awkward on foot, but that they should be dressed in a practical service-like manner; they may have smart clothes for home service, but for the field let them be dressed in a practical manner. It appears to me cavalry thoroughly trained to act as infantry at need would be very much more valuable than any improvised force of mounted infantry you could in any fashion raise. The impossibility of training the same men to be efficient cavalry and efficient infantry has been alluded to by more than one speaker, and many great authorities have been quoted on the subject. It was stated by Sir Archibald Alison that the experiment had been tried in every age and had always failed. But yet two of the greatest military nations of the Continent are trying it now; they have not given it up as a bad job. The Germans scouted the idea of mounted infantry, they say that their cavalry may be made to do all the work that is required of mounted riflemen, and moreover believe that the cavalry thus trained will not lose the power of showing the dash displayed so conspicuously at Rezonville. It remains to be seen whether they are right in this assumption, and I am inclined to think that ultimately, if the higher authorities insist upon the performances of this double duty, well-trained cavalry will be found equal to the task. Take the case of pure infantry; foot soldiers are very often required, particularly in the present day, to dodge behind cover, to act strictly on the defensive, to hide themselves as much as possible, and to do a great many things which would seem rather to injure their offensive position, but the very same men may be required on another occasion to

charge in the most reckless way a battery or position, and carry it in the face of great odds. We do not find as a rule that they shirk that sort of work. I think it only a question of training, instruction, and discipline, and you may make the same men excellent fighting cavalry and good useful infantry. The Russians have converted the whole of their line cavalry into what is practically mounted infantry, but they are expected to act as cavalry, too, upon occasions. These "dragoons" are armed with a long rifle and bayonet to work with on foot, but they are also armed with a sabre, and are expected to fight on horseback too. It remains to be seen whether the experiment will answer.

Colonel CHARLES EDWARDS, 2nd West York Yeo. Cavalry: It seems to me that the Yeomanry must enter so largely into the consideration of the questions which have been raised by the lecturer that some Officer of that force ought to take part in this discussion, and therefore as briefly as possible I should like to express to you what I believe to be the views of Yeomanry Officers upon this subject. The Officers of the Yeomanry are not averse to their men acting as mounted riflemen, but they do not want them to be converted into mounted infantry, for this reason, that in the first place the Yeomanry wish to serve primarily as mounted troops, and in the second, mounted infantry must be the very perfection of infantry merely temporarily mounted for tactical purposes, and to this standard of efficiency neither the Yeomanry nor the mounted men attached to Volunteer Corps can hope to attain. On the other hand, this force presents the very best materials for mounted riflemen, and I hold that from the Yeomanry could be raised as valuable and efficient a body of mounted riflemen as you will find in any country out of South Africa. With reference to the scheme Major Hutton has proposed in Section 3, with all deference to Lord Wantage's remarks, I would say that from the Yeomanry alone, or at all events with their co-operation alone, you will be able to carry out that scheme. My experience of the Volunteers tells me that you cannot expect to get from them a sufficient number of men possessing the necessary qualifications for mounted infantry. As a rule Volunteers are raised in large towns, and from a class of men utterly unacquainted with horses or stable management, or even with a knowledge of the country and the signs of nature, and if you put such men on horses, I do not care from what class they come, who are not accustomed to the care of horses, and set them to gallop about the country, you will in a very short time have as many sore backs as you have horses. In support of what I am saying, I would refer to Appendix II in the lecture. The C Company of the 2nd Battalion corroborates my theory. That company is formed from regiments with which I am acquainted, and which are raised in the county which is always supposed to be the most horse-loving county in England, and yet I do not believe that you could get one division of men possessing all the characteristics of mounted infantry out of those battalions, and in looking down the list of headquarters I do not feel more sanguine. I would make one suggestion, which I believe to be highly practical, and that is, if you do want to raise a force of this kind, either as an auxiliary to the regular forces, or as a purely auxiliary force, the Government should look upon the Yeomanry in precisely the same light as they look upon the Post Office Volunteers, namely, as troops possessing special qualifications for special duties, and as in an emergency they call upon the Post Office Volunteers for men to perform duties connected with the postal and telegraph services of the Army in the field, so they should call upon the Yeomanry for a contingent of mounted riflemen. In the result of such an appeal I have every confidence. On two occasions when war has been imminent, I have volunteered to raise a regiment of Yeomanry for service abroad, and my appeal to the men has been responded to in the most satisfactory manner. I know that a similar result has been obtained by other Officers, but at this late hour I will not trespass on your patience any further.¹

Colonel CHURCH, 3rd Middx. R. Vols.: I should not have had the presumption to address you to-day, if it were not that I am in the position of being one of the

¹ Had time permitted I wished to have taken exception to the lecturer's curt dismissal of the idea that the Yeomanry could ever become cavalry. His expression "six days' training" is altogether a misnomer, and in no way represents the duty annually performed, or the many weeks of riding school with which men and

other Volunteer Officers who have at last obtained liberty to form a detachment of mounted men. It may perhaps be useful, with reference to the force to which I belong, to say in very few words what are our real difficulties, and the way in which we think we may overcome them. The regiment which I command has detachments all over the north of Middlesex, from the River Lea to Hampstead and Hendon, and for years I have had thoroughly good infantry men in my corps, as far as we can make them good men, who have their own horses, and who were anxious to enrol themselves in a force of mounted infantry, not for service anywhere else, but with our own particular battalion, and for our own particular service. We had considerable difficulty in getting this leave; we were always received with the greatest kindness by the military authorities, but I believe our applications always came to grief when the official Secretary at the War Office had to look through the estimates. However, on my third application I obtained leave, with the usual caution that there was to be no expense to the country beyond 30s. per man per annum. I must say, as far as matters have gone, I have received every assistance from the War Office with reference to accoutrements, but they were obliged to wait before furnishing them, until some accoutrements that were out on loan had come back again. We got some partly worn ones supplied, after the manœuvres at Easter were over: they were very cheap, being only about a quarter of the original cost. Now it seems to me the first matter to be considered is that I was very much struck with Colonel Russell's lecture with reference to remounts and the cast horses of the cavalry. If we could only get these at a moderate price (for you get nothing given to you), some of these cast horses would be an enormous assistance. Although your men may be nothing but mounted infantry, still, whenever you have a horse, you like to have a good horse if you can, and if you get a dozen men out as mounted infantry, you like to have the horses somewhat uniform, and somewhat accustomed to the ordinary things which disturb hired horses, firing, bands, and things of that kind. Therefore I believe that if any suggestion of that kind can be carried out, it would be an enormous assistance to us. There is one other particular matter which no doubt could be readily got over. I am thinking of filling up a vacancy in my regiment among the permanent staff of instructors, by having a man who served with the mounted infantry in Egypt, and who is now giving instruction to my men. The difficulty that I shall have first to meet is one of the Volunteer regulations that says that when you apply for a sergeant instructor, he must belong to the particular battalion or battalions to which you are allied. Well, if they have a good man, all well and good; but in all human probability there will not be a man competent to teach mounted infantry drill at our dépôt. I daresay there will be a way out of it, but it is very important to secure good instruction. The next matter is this, that when you go to the field drill, there is not the slightest consideration paid you with reference to your horses. It seems to me that it is a frightful difficulty in this country for any railway company to put a couple of horseboxes on to any train at all, and when they do get your horses on the line, when it is made a favour by writing to the general manager of this company or of that company, it does seem to me a ludicrous thing that you cannot send twenty horses down on any railway by giving a short notice, and that those horses cannot be delivered at their journey's end without being ten or twelve hours on the road, where ordinary trains take two hours and a half. That seems to me a thing which the War Office or the authorities ought to get over. It is a matter that requires a little pressure. The fares are just the same with reference to horses sent down in that way as they would be if you sent your own horse, and you were going hunting. That is not quite the thing; you ought to have the power of sending carriages and horses used for military purposes at military rates. I sent a service wagon to Shorncliffe the other day, and paid just at much as if I had sent my own carriage; that is not right. It would be very improper for me to express an opinion about the mounted infantry question generally in war. What we want our men for is the service of our own

horses should be credited. Three or four strong regiments of admirable cavalry might be raised from the force in a very short time, and we should therefore hesitate before we alter the training of the Yeomanry in the manner he suggests.—C. C. E.

individual battalions. You cannot have outpost drill, as I am happy to say I have been having it in my own regiment for some years, properly conducted without having mounted men for the purpose of keeping up communications and scouting. I assure those who have not tried the experiment, but who have thought about it, that if they will only try it in districts suitable for raising these mounted infantry, they will find it give a great deal of interest and life to their drill. I do not think you can possibly expect to have mounted detachments in regiments where their headquarters are in towns, because if you have to hire horses, it is fatal to the whole thing.

Major the Hon. JOHN HENRY NAPIER: My friend Major Hutton has drawn attention to a subject which no doubt should be settled, and ought to have been settled long before this, a subject which has been brought prominently before the public from time to time ever since the first Afghan War. I think, however, that his idea of creating a mounted infantry force from the regular infantry regiments by drawing detachments, is not a practical way of settling the difficulty. I maintain, from personal experience of an infantry regiment, that there is nothing so likely to demoralize and to render it useless in the field as the practice of withdrawing from its ranks volunteers such as you require, and such as would be drawn for this mounted infantry or other special corps. It has a most demoralizing effect upon the men remaining in the ranks; it withdraws just that percentage of *esprit de corps* and manly dash which is necessary to lead men in the field. For example, my own regiment, the 92nd Highlanders, when on service in Afghanistan, had to contribute a mounted infantry corps; had this corps been obliged to take the field and leave the impoverished ranks behind them, I think the regiment would not have done the gallant service that it did. I can quote in proof of this that Major White, now General White, V.C., and Adjutant Dick-Cunyngham, V.C., were both selected as mounted infantry Officers. What effect would such a loss have had on the regiment? The two most gallant Officers in the regiment taken out of it at the critical time when they were most wanted—what would have been the result, I say, on the 500 men left in the ranks? I perfectly agree with every word that Sir Edward Hamley said as to the detrimental effect that such a proceeding would have upon British infantry. I will, however, lend my cordial support to Major Hutton, in his contention that it is useless to create a special corps of mounted infantry, for I believe with him, that they would only degenerate into bad cavalry. I think one of the other speakers suggested a practical way out of the difficulty, namely, that the ordinary infantry regiment should be taught to ride sufficiently well to transport them from one place to another, which is what we really want to do. We want to carry a pony force of riflemen from one spot in a limited space of time to another, and that could be effected by giving the men an elementary idea of riding ponies. Those ponies would be supplied at Aldershot or other military centre. The rest of the duties of mounted infantry can be and have been well performed by cavalry regiments. The 15th Hussars, under Colonel Luck, supplied a force of mounted infantry, which was out and out better in every possible respect than any impromptu force that has yet been created. The 15th Hussars were able to dismount and climb over difficult ground; all they required was an easy pair of boots and an accurate rifle to make them the finest infantry in the world.

Colonel FRANK RUSSELL, Royal Dragoons: My lords, ladies, and gentlemen, I should not have ventured to trouble you if the Chairman had not invited cavalry Officers to offer remarks on this subject, and therefore, as no other cavalry Officer has hitherto spoken, I shall ask permission to make a few remarks, which I need scarcely say will be of the shortest description. It has been taken for granted that if any mounted man is trained to fight properly on foot, and to use his carbine, he will therefore become useless as a cavalry soldier. I see that the lecturer quotes various authorities in support of this view, mentioning Rosser, and "one of our best known authorities upon cavalry," whose name, however, he does not give. I venture to think that these opinions are slightly opposed to all the lessons taught by recent campaigns. I have taken the trouble to read very carefully the records of the French and German war, and I find that on many occasions the German cavalry were used on foot with the greatest possible advantage, and no one

can say that they did not also perform their duties as cavalry with great efficiency. It appears to me, as a cavalry Officer, that it is a positive slur upon our branch of the Service to suggest that we should not be properly instructed in the use of the weapons with which we are armed. I also believe that if cavalry are trained to fight on foot, they can perform all dismounted duties just as well as mounted infantry. The cavalry, however, is a very expensive force, and I am sure we all agree that, as regards numbers, it is far too small, hence we should welcome all the more warmly the establishment of mounted infantry as a help and assistance in time of war, more especially as it will be an inexpensive force, which there may be some chance of the House of Commons sanctioning, while they would not agree to an increase in our cavalry. The lecturer and Lord Melgund have been kind enough to refer to a lecture that I gave here last year on the subject of horses. I can only now repeat that I am more than ever impressed by the lamentable and crying want of a reserve of horses. In a campaign there is a far greater wear and tear of horses than of men. I need scarcely refer to the Crimean campaign, when our entire force of cavalry was dismounted. I therefore most earnestly hope that when the question of mounted infantry is considered, that necessity of a reserve of horses will not be forgotten.

Lieutenant-General Sir JAMES HILLS-JOHNES, V.C. : I will not attempt to make any observation upon the lecture, as there is no time for me to do so, but will only give my support to the statement made by Sir Lumley Graham and Major Napier that the cavalry can be trained to take the duties which it is thought can only be performed by mounted infantry, and will be a more effective force, and I will strengthen this opinion by pointing out that the moral effect of the knowledge that a force which has suddenly developed itself by its rapid movement on the flank of an enemy or on any other point, can, after developing a heavy fire, suddenly transform itself into cavalry and charge will be immense. This is, in my belief, the reason that the armies of Germany and Russia have taken up the question of training their cavalry, not as mounted infantry, but to take up the rôle which it is intended that mounted infantry should take, and I am quite certain that this training will tell greatly in the next war in which they are engaged.

Major HUTTON : At this late hour it will be almost impossible for me to reply in detail to the criticisms which have been offered. Sir Edward Hamley opened the discussion by speaking rather strongly on the subject, and rather implying that I was suggesting some alteration in our present military system. It was not my intention to do anything of the sort, and I am not in a position to attempt to criticize the system that exists at the present moment. What I have endeavoured mainly to show in my paper is a want that I think has been very generally acknowledged for some time past, namely, that our cavalry is numerically very insufficient for the duties required of it. I am well aware that my paper is in many respects imperfect. In attempting to deal with a very difficult question, I have merely endeavoured to suggest a way out of an obvious difficulty, and prefer to leave it to Officers of larger experience than myself to comment upon my effort. I do not suppose that my suggestions are in any sense perfect; I merely plead they may be considered as an attempt to deal in a practical manner with a very pressing question. I am accused of tampering with the regimental system. No one appreciates our regimental system more than I do. The efficiency of the Army owes everything to our regimental system, and the mounted infantry detachments, distinguished as they have been in recent campaigns, owe their reputation and success entirely to the regimental system which exists in the regiments from which they come. I perfectly agree with my friend Major Napier, and Sir James Hills-Johnes, that cavalry can do all mounted duties far better than the best of mounted infantry. But the question is, have we sufficient cavalry to perform such duties, and further, can we afford to sacrifice a certain amount of their efficiency in teaching them to act as infantry, or is it better that they should keep themselves to their rôle as cavalry, and merely learn their dismounted duty as an adjunct to their cavalry duties? This latter question is one which I prefer to leave open. Cavalry Officers of experience have a right to give an opinion on that matter. Sir Redvers Buller led us to understand that he anticipated in future campaigns mounted infantry would play a very important part on the Continent of Europe. My suggestions

have in large measure been made with this consideration in view, namely, that we should give to a certain number of our infantry soldiers an amount of practical training. Lord Wantage and Colonel Macdonald, and other distinguished Officers of the Volunteer Force, whose opinions are extremely valuable, seem to be perfectly in accord that those mounted infantry companies which exist now might be very easily maintained, and that they are consonant with the sporting instincts of Englishmen, and with the military feeling of the Volunteer Forces generally. I have endeavoured to point out that unless some central school of instruction be established, at which Officers and non-commissioned officers and a proportion of the men can be put through a course of instruction, the mounted infantry companies or battalions can never attain to a real and practical efficiency. There must be one universal system of drill and interior economy. I know in one case particularly, that in Lord Mount-Edgcumbe's company it has been found a most pressing difficulty to obtain any sort of instructor for the men. What I would urge therefore for the Volunteer Force is that some such school as that suggested should be called into existence at Aldershot. At that school non-commissioned officers from the regular troops would go through the course that I have indicated, and these non-commissioned officers passing eventually into the reserve would form exactly the class of instructor a Volunteer Officer would wish. Without assistance of that kind the mounted infantry companies would die a natural death. Sir Lumley Graham has rather misunderstood what I said about discipline. I never intended to infer that in the recent campaigns the discipline had been bad, but I do maintain that our fire discipline is defective, and this, I think, is the opinion of the very large majority of regimental Officers. In my remarks about discipline I have stated that the tendency of the present day in the Army and elsewhere is to relax the law of discipline, and we should bear this liability and this feeling in mind in dealing with all matters of military organization, such as a *corps d'élite* of the kind I have attempted to describe. Colonel Edwards, Colonel Church, and other Officers of the Volunteer Force have endorsed my views as to the necessity of forming a mounted infantry brigade in cases of emergency, and they have testified to the fact that among the Volunteers there are a great number of men who would be perfectly ready to come forward and offer their services in any part of the world where they might be required. In reply to Colonel Macdonald, I did not mean to imply that the men should be enrolled now; the Mounted Infantry Volunteer Brigade scheme would merely be called into existence when a national emergency arose. I wish in conclusion to express my thanks to Mr. Caton Woodville, who has painted expressly for this occasion this very able picture. It is a mounted infantry soldier, and has been extremely carefully painted, and every portion of the equipment and detail has been worked out accurately, according to the latest mounted infantry regulations.

Colonel MACDONALD: Will you say anything about the double mount for each horse?

Major HUTTON: I have purposely not entered into any question of detail in this lecture. I have attempted merely to deal with the question of mounted infantry broadly. The details connected with my scheme are so numerous, that it would be almost impossible to touch upon them.

The CHAIRMAN: I am sure at this late hour of the evening, after all the very interesting speeches you have heard, you do not all wish me to go over the ground which has been traversed so well by many of those who have just spoken; but the subject is one of such intense interest, it is one that opens out not only matters of detail to which reference has just been made, but also some very broad principles, that I hope you will bear with me if I say a few words upon the general topic. I think there is one point in which every one in the English Army, certainly every one who has had much experience in recent wars, are perfectly agreed, and that is that mounted infantry as a force in the field is of incalculable value. I think it is only men who have had really practical and actual experience in the field, and under fire with troops, who can appreciate the real value of mounted infantry; but at the same time I think we must not wander away from the idea of mounted infantry and confuse that force with cavalry. My idea of cavalry and of mounted infantry is, that they are almost two distinct arms of the Service,

or, at least, they ought to be so ; although the mounted infantry man rides a horse or a camel, he is far more allied both by name and certainly by his duties to the infantry than he can be to the cavalry soldier. I will at once dispose of the idea with reference to cavalry soldiers doing the work of mounted infantry, in my own mind at least and with arguments that commend themselves to me, by adopting what has been said by several of the speakers, that a cavalry regiment if armed with a long rifle would be far better qualified to perform the duties which are now done by mounted infantry than any body of mounted infantry I have ever seen put in the field. But then our cavalry are not armed with the long rifle, and there are, I think, other reasons why our cavalry should not, if possible, be used as mounted infantry. I think I may say what my views are on this question. I look upon our cavalry as the first cavalry in the world ; there is no cavalry that I have ever seen to be compared to them either as regards men, horses, equipment, or instruction. As pure cavalry they have always shown in the field what they were worth. We can always depend upon them to perform their duties in a manner that no other cavalry can excel. But having so small a force as we have of this very highly organized, highly trained cavalry, I think it would be just as sensible to devote them to mounted infantry work as it would be to employ a Nasmyth hammer to break walnuts. It is not only a question of cheapness but of expediency. We can furnish the men for mounted infantry either from the line, militia, or Volunteers. The first time I saw a large force of mounted infantry in the field it was not counted by companies or by hundreds, but by thousands ; that was in America. I there saw the largest force of mounted infantry ever put into the field. They were nominally called cavalry by those who did not know what cavalry were, but they were purely and simply infantry in every way, and armed and drilled as infantry. They had the locomotive power, or a certain amount of the locomotive power of cavalry ; the most distinguished of all their leaders was an infantry Officer, General Sheridan. That force of mounted infantry, made such good use of in the American War, was improvised in a very short time, and I am quite sure what was done in America from 1862 to 1865 could be as well done in this country, where there are such numbers of men who, having left our Army, have carried away from it much very useful information upon all military subjects. An appeal properly made to these men would bring most of them back to our ranks in any emergency, and our authorities would find without difficulty amongst the Volunteer Forces and the militia, and the various men who have passed through those services, enough men to form a division of mounted infantry that would in every way be quite equal to that which I saw in America, and which did such gallant and magnificent service during the Southern struggle for independence. Then, again, we are told the cavalry soldier ought to be as good on foot as the infantry soldier is. I do not believe in the jack-of-all-trades ; I think he is a myth. I believe the cavalry soldier ought to be taught to fight on foot when it becomes necessary to make him do so, but in my opinion to make him do so except in an emergency is a waste of power. The Germans teach their cavalry to fight dismounted and to do dismounted duties. I have never served with German cavalry in the field, but I have attended their manœuvres and watched most carefully the large force of cavalry employed. I can conscientiously say that during the seven or eight days the manœuvres lasted I saw only two squadrons fight dismounted. So much as to the extent to which they employ their cavalry as mounted infantry during their annual manœuvres, and, I think, if you inquire into the history of recent German wars, it will be found that the numbers of times the German cavalry were dismounted and used as infantry were very few indeed. They were used for purely cavalry purposes, that is occasionally for magnificent cavalry charges, their great rôle, however, being to obtain information of the enemy's doings and intentions, and to form a screen for their own army for the purpose of keeping at a distance all prying scouts, and to prevent the enemy from finding out what they were about. That is what I have to say as to the use made of the German cavalry during recent years. I cannot possibly pass over in silence a statement made by Sir Lumley Graham, who spoke of the discipline of the corps lately employed in Egypt as being bad. In reply to it I can only say that as regards my own experience in the Army, and on active service, I have never served nor heard of any Army, large or

small, in which there was less crime, and in which the men behaved better in every way in which soldiers can be tested in the field, than the men with whom I was associated, not only in 1882 but also in 1884 and 1885 in Egypt.

Sir LUMLEY GRAHAM: I did not assert myself that the discipline was bad. I quoted the lecturer, as I understood him to imply the discipline was bad. I said, on the contrary, I hoped it was not the case.

The CHAIRMAN: I am very glad to hear that, because it certainly was not the case, and the lecturer or any Officer who was present in Egypt on either of the occasions to which I refer will bear me out in what I say. With regard to mounted infantry generally, we do not want them as a substitute for cavalry; we want them to help it. My own notion is, that in the future, if we look forward to a war—and we may have it at any time forced upon us—the army that will have with it in the field a large mounted infantry force, whether that force be mounted upon donkeys, camels, elephants, or any means by which they can get about quickly from one place to another, and will have with it a sufficient ingredient of regular cavalry to act purely as cavalry, to charge when necessary, that will also have with it some light guns and especially machine-guns, the army possessing such a force, and whose leaders know how to use and to handle it, will have an enormous advantage over an army that adheres exclusively to the stereotyped employment of cavalry, infantry, and artillery. There has been a great deal said about how these mounted infantry should not be formed, and during the discussion we have heard a great deal about regimental discipline and regimental *esprit de corps*. I am sure it is like painting the lily in addressing this or any audience of English soldiers to dilate upon the importance of regimental spirit in an army. Any man who has ever served in any army, especially in ours, is well aware how absolutely necessary it is to keep our army together, in fact it goes without saying. I cannot, however, think that those appreciate this feeling properly, or have taken a right view of it, who say that if you take away 50 or 60 men from a battalion of 600, or 800, or 1,000 men, you utterly destroy that battalion, or that taking away from a battalion, as one speaker said, two Officers, who afterwards distinguished themselves and won the Victoria Cross, was to destroy the efficiency of that corps. All I can say is, I hold our regimental spirit in much higher estimation than to imagine that taking away even the two very best Officers, even supposing them to be a real Wellington and Napoleon, would destroy any British battalion I have ever known. We have plenty of good regimental Officers, and there is no battalion in the Army that could not spare two or more Officers for mounted infantry work, and spare them well. We have been told during the discussion how we must not get these mounted infantry together, but we have not had, as far as I can remember, one single practical proposal as to how a large force of mounted infantry could be collected together. We have certainly had it proposed to mount a complete battalion on horses. Any one who knows how our battalions are composed will recognize the difficulty of doing this, and any Officer of experience with mounted infantry in the field will tell you that it would be impossible to expect from any such corps all that we are accustomed to get from mounted infantry. You could not get the same amount of work out of a battalion of ordinary infantry that you would get out of two-thirds the number of selected men. I do not know of any more practical plan for creating a corps of mounted infantry when required than that which has been proposed by the lecturer, namely, to establish at home a good school for mounted infantry. The larger the number of Officers and men sent through such a school, the more easily would a battalion of mounted infantry be raised when the necessity for it arrived. I believe that in the future, as in the past, we shall always be obliged to raise it by drawing so many good and selected men from each of the battalions it is not intended to send into the field. I hope that whenever this is done the battalions left behind will, for the reputation of the regiment, if for no higher motive, take care to send their very best men. Each small knot of men thus supplied will go into the field under own immediate Officers, each carrying with it the traditions of its own regiment or battalion, and proud to show the Army it is serving with, the stamp of men that regiment is composed of. Thus a regiment, although not actually in the field itself, although it may be at home in quiet garrison, yet has its feelings and its traditions well represented in the war by men of whom that regiment may well

be proud. Now, gentlemen, I have nothing more to do than to convey to the lecturer, as I am sure I am justified in doing, the thanks of everyone present this afternoon for having brought this subject so ably and clearly before us, and I would also tender our best thanks to those who have taken part in our interesting discussion.

Friday, June 4, 1886.

LIEUT.-GENERAL SIR FREDERICK FITZWYGRAM, BART., M.P.,
in the Chair.

A RESERVE OF HORSES.

By Colonel F. G. RAVENHILL, R.A., &c., &c.

ONE of the most widely accepted principles in the requirements of modern war is the necessity for a rapid mobilization of all arms.

In this country we have our regiments, batteries, and troops of the 1st Army Corps, the establishments of which are kept up, to a certain extent, in a matured state of preparation for active service.

Then we have the troops forming the 2nd Army Corps, for which certain defined establishments are laid down, with a third section of our forces belonging to no particular army corps, which are on the lowest scale so far as their strength goes.

As regards the personnel of the Army, we have our dépôts for men with reserve forces, and to supplement these an organized Militia and Yeomanry, with thousands of Volunteer artillery, engineers, and infantry, certain medical staff and hospital corps.

To supply material we have our arsenals, magazines, dépôts, and stores for arms, ammunition, camp equipment, and clothing, with a highly trained though numerically small Ordnance Store and Army Service Corps for their issue.

But with regard to any reserve of horses—or even procuring the same—there is no provision, and our organization under that head is altogether deficient; for though an impress of carriages and horses is sanctioned for the transport of baggage, &c., by the Army Act of 1881, no machinery exists for its application.

Hitherto we have blindly calculated on our own country being able to furnish us with horses in time of need—but even in peace-time these resources fall altogether short of the ordinary commercial requirements, as shown by the Board of Trade Returns, from which it appears that, exclusive of Ireland, in the past decades our imports and exports of horses have been as follows:—

| | Imports. | Exports. |
|-------------------------------------|----------|----------|
| From 1876 to 1885 inclusive | 177,058 | 51,127 |
| „ 1866 „ 1875 „ | 80,603 | 41,264 |
| „ 1856 „ 1865 „ | 20,829 | 34,539 |

The Returns only give the five years previous to 1856—

| | | |
|----------------------------------|--------|--------|
| From 1851 to 1855 inclusive | 21,936 | 11,875 |
| Then for the year 1851..... | 3,443 | 1,526 |
| „ 1841..... | 339 | 4,538 |
| „ 1831..... | 1,063 | 718 |

The greater part of these importations have been from foreign countries, whereas if once the trade were properly developed with our Colonies much of that supply might come from our own Colonial stock.

I have had reason to think that Ireland has been falling short in its supply, and learn that during the year 1885 there were no less than 2,487 horses imported into that country, showing that even there the supply does not equal the requirements—it is true that the exportations have been very large, reaching to almost 25,000 during each of the last two years.

The consequence has been that when a sudden demand for horses has set in, we have been at our wits' end to know where to find them suitable for war purposes, and have had to take any supplies procurable.

On reference to the latest War Office Returns it appears that the number of horses required to complete the full establishment of regiments of cavalry, batteries of artillery, engineer troops, infantry, and general transport of—

| | | |
|---|---|---------|
| The 1st Army Corps is 11,483 exclusive of 1,571 Officers. | | |
| The 2nd Army Corps 11,483 | „ | 1,571 „ |
| Or a total for two | | |
| Corps d'Armées .. 22,966 | „ | 3,142 „ |

The number of horses in the possession of Government for this financial year, exclusive of those in India, is shown as 14,151; but from this must be deducted 1,200 employed at other stations abroad, reducing the number at home to 12,951 horses.

From this last number must be deducted those too young, too old, also the sick and lame, or allow 20 per cent., say 2,580

Leaving a total effective of 10,371 only,

or about 1,100 horses under the number required for one army corps, and 12,600 for two, exclusive of Officers' horses.

Where lines of communication have to be maintained 2,773 additional horses are required for each army corps, making a total deficiency for the two of 18,100.

For the completion of only two army corps with their lines of communication there is a deficiency, as shown, of 18,100 horses; and in addition there should be a reserve to feed the waste of one campaign, 40 to 50 per cent., or say 9,000 more: in the Crimea our waste amounted to 80 per cent. per annum.

The men for one army corps could be mobilized in three weeks;

but it would take a much longer time to procure the horses necessary to complete even that one small fighting body.

In 1882 it took seventeen weeks to procure 1,700 horses, which was below the numbers required to complete the establishments.

At the same rate it would take 170 weeks to complete the establishment of horses for two army corps—and we should still have to provide for the remaining requirements.

It is true that delays arose in the arrangements, which may not recur in the future, but in the absence of any well-matured organization the purchasing of suitable horses in any numbers must necessarily occupy a considerable period.

By the latest Census Returns it is shown that there is a total of horses in—

| | |
|---|-------------|
| Great Britain and Ireland of | 3 millions. |
| Of which there are employed in agriculture .. | 2 „ |
| And privately or in trade about | 1 „ |

After deducting those too young or too old, the too small, too big, and those unsound or otherwise unfit, there would be only 70,000 horses available; in this number are included the high-fed London carriage horse and the well-stalled hunter. Could they be purchased, or, if they could, are they suitable to the exposure of active service? My calculations reduce the number to less than the 70,000.

To admit of rapid concentration some well worked out scheme of supply is essential for success, and in considering the question it must be remembered that horses to go on a campaign should be seasoned, if not duly trained in a military sense.

If our cavalry is to scout and outflank an enemy, or our horse artillery is to be capable of making forced marches and rapidly moving to the front to hold positions in support, we require a body of horses available which are full of keep and muscle—with heart for their work, as we cannot expect green, fat, unformed animals direct from the graziers or dealers to be able to make long marches or gallop to the front with our telegraph wagons and signalling parties. This opinion of the necessity existing for seasoned horses where hard work is required of them is supported by the experience of the largest employers in the kingdom to whom I have referred; and even for their steady work a period of preparation is found necessary.

| | |
|---|-------------------|
| Some of the leading jobmasters..... | say 2 months. |
| „ „ cab-owners | „ 2½ „ |
| „ „ omnibus companies | „ 1½ to 2 months. |
| „ „ railway „ .. | „ 3 months. |
| „ „ carriers | „ 2 to 3 months. |
| „ „ experienced veterinary surgeons..... | „ 3 to 6 months. |

Our great want in war has always been that of riding and horse artillery horses, a certain number of ordinary draught and pack horses, with other beasts of burden, have been procurable. That

Wellington was in constant want of horses is evidenced by his despatches, the following extracts illustrating this :—

Wellington to Lord Castlereagh, 22/6/1809.

“ I hope you will send the remount horses soon. I have given to the 14th and 10th Light Dragoons 95 horses from the Irish Commissariat, and believe I shall give some to the other regiments. This arrangement and the draft from the 3rd Hussars will keep up the regiments for a short time ; but it is inconceivable how fast the horses of both cavalry and artillery fall off.”

Wellington to Lord Castlereagh, 27/6/1809.

“ The brigade of heavy cavalry, which has not yet done a day's duty, is obliged to leave here nearly 100 horses, and the brigade which has been to the northward is so much reduced that they are happy to take 110 horses of the Irish Commissariat. I hope, therefore, you will send us the remounts as soon as you can.”

Wellington to Lord Castlereagh, 25/8/1809.

“ The English have about 2,500 cavalry left. I shall be very glad if you will send us the remount horses, and any regiment of dragoons that is to come, as soon as possible ; the best thing to do then, probably, would be to draft the horses of one of the regiments to complete the others, and send that regiment home dismounted. It would be very desirable also to send us 600 or 700 sets of horse appointments.”

Wellington to Lord Liverpool, 5/2/1811.

“ Recommends Government should buy 50 to 60 horses at from 40*l.* to 50*l.* a-piece for Officers to purchase. If they went into the ranks the only loss would be the difference between 40*l.* and 30 guineas—the ordinary price.”

Returns Nos. 1 and 2 enclosed with Despatch to the Duke of York,
10/2/1813.

5,175 horses present, 1,070 deficient ; the 4th Dragoon Guards, 9th Light Dragoons, 13th Light Dragoons drafted home, so as to reduce men to 5,119 (from 6,245).

Hitherto when an emergency has arisen, we have had to supplement our island resources with Spanish, Barbs, Syrians, Flemish, and Colonial horses. All will remember in the Crimea what a large proportion of our riding horses were foreigners, with an inconceivable number of mules in draught, which are but poor substitutes for our home-bred horses, and if they had had to do any continuous marching, would have hopelessly broken down.

Foreign nations have foreseen these deficiencies, and have their Officers and cavalry mounted on Irish and English horses, and are

we to be exposed to meet these well-mounted troops under disadvantageous circumstances on small Asiatic stock? for in a charge, weight combined with blood will tell.

The great foreign Powers have always a certain surplus of horses in hand during times of peace, which, on the outbreak of war, are drafted from the Service into reserve squadrons. Why should not we partially adopt some such arrangement?

Gentlemen, the great struggle which took place on the Rhine in 1870 between France and Germany demonstrated the effect of the most perfect organization and preparation, and the want of it; the result of the latter was attended with overwhelming defeat and humiliation.

Is Britain to lay at the conqueror's feet for want of preparation and forethought? Is it conceivable that we should be given several weeks to provide horses for one Army Corps, a work which ought to be done in a few days? Now is the time to form and complete the requisite organization—now is the time to prevent disaster!

The question then presents itself, where and how are we to maintain or procure the necessary number of horses?

(1.) Government could increase the number in each regiment and battery, say 20 per cent., which would insure the establishments of the few corps kept up to 1st Army Corps strength being efficient; this would entail the maintenance of 2,300 horses more than we have at present. I am informed that the cost would be about 24*l.* per head per annum, or 55,200*l.* for the whole, to which must be added the original cost of the horses, say 98,550*l.*, being a total of 153,750*l.* for the first year; in subsequent years the cost would amount to 69,300*l.*, including 5,520*l.* for the keep and 14,100*l.* for the purchase of renewals. This does not include cost of extra stabling, pay and clothing &c., of extra men, which would be considerable.

(2.) We might have dépôts where young stock, purchased at from two to three years of age, might be reared, thereby enabling the breeders to realize their money earlier; but this would not insure a supply of seasoned horses, and would entail considerable outlay and a costly maintenance.

(3.) A proposal has been made by one or two Officers, who have thought the matter out, to form a reserve by passing horses through the ranks of the mounted branches on a short service system, selling all such as are over ten years of age, but registering and holding a lien on them up to fourteen or fifteen, thus being able to take them back at a price to be fixed on a decreasing ratio according to their age. Such a system would entail the outlay of much money, and would have a tendency to impair the efficiency of the mounted troops through the loss of their horses whilst still in their prime.

(4.) A further idea, somewhat the same as the last, only not so wholesale, is to sell out from the Service all mares over ten, holding a claim on them; but as these mares would obviously be used for breeding purposes, they could not be considered available or fitted for active service, and the same objections as given by me in the last case would hold good in this.

(5.) It has been proposed by some to give a subsidy to such of our Yeomanry as may be willing to receive it, for allowing their horses to be called up when required on the condition that they provide for themselves other efficient troopers within a given time.

Objections to this may be urged, that many of the horses the Yeomanry are mounted on are said not to be their own; if such is the case, it is a matter for correction.

It is also thought that you would be taking the horses of the Yeomanry just at the time when their emergent services might be required.

(6.) It may be urged that the Army Act of 1881, sect. 115, previously referred to, affords the opportunity of impressing, in case of an emergency, every description of conveyance and of horse, whether it be kept for saddle or draught; but it is not clear to me how the law stands, as to whether the purchase or only a hiring is contemplated; and whether the conveyances and horses could be used out of the United Kingdom; so far as I can learn, no registration of available carriages is kept up at police stations, no provision is made for the purchase of the same; and it is to insure some measure of this kind being adopted that I am addressing you to-day.

(7.) Another scheme is to register every horse plying for public hire in the United Kingdom, for which we partially have the machinery in the hands of local authorities, as the owner of every public vehicle has to procure a licence; and whilst this is being done, the horse might be inspected, and, if found fit, classified, the proprietor being subsidized annually; if his animal is at any time required by the State, the full value at that time to be given for it; in case of dispute arising, the price to be settled by arbitration. There are objections to this, as it would fall on one class of people. The number of horses thus obtainable would be limited and would not be very serviceable.

(8.) Colonel Keith Fraser, in an article on Army horses in the "Fortnightly Review" of October, 1884, suggested that some system of registration should be adopted for every horse or pony offered and suitable for military work. For this purpose and to meet the necessary outlay, it is suggested that the horse-tax, as it existed up to 1874, might be re-established; the money thus levied, which then amounted to 450,000*l.* a-year, would more than cover the estimated cost of registration, subsidizing brood stock, and a considerable balance would remain available for the Treasury. Under the Act proposed all horses registered for sale to Government should be exempted; if found necessary, a small additional subsidy might be given. The value of the horse at the time of registration would be recorded. Should this amount appear to the Government Inspector to be excessive when the horse is required to be purchased, the amount to be paid would have to be determined by arbitration, in the event of his not being able to come to terms with the owner. Objections may be made by the revenue officials to this class of tax, on account of its many exemptions, but I may instance the existing dog-tax as one having such.

Returns of horse-owners claiming exemptions would be forwarded by tax collectors to the District Government Inspectors, who would take periodically an opportunity of arranging to see the horses and judge of their capacities for registration.

No unsound stallion or mare, nor such as are quite unfitted from hereditary causes to breed a troop horse, should be exempted from paying the tax. On the other hand, every stallion or mare that is made use of for breeding purposes of good hardy colours, of a certain age and standard, and which are, in the opinion of the inspectors, fitted for getting troop horses, should be subsidized with a considerable annual premium.

Good mares are becoming very scarce, and proposals have been made to tax them when exported; but if a Government subsidy were given annually to such as are kept for brood, it might keep them in the country and do much to re-establish the breeding of good horses at home, a branch of national industry now rapidly declining.

Some may say that the amount required will be so large no Government could entertain it, but I would not propose to subsidize the fat, sleek mare of 15·3, running in a London brougham, or the good 15·3 huntress still carrying fourteen stone across country, until such are made use of and are still fitted for throwing a suitable foal; indeed should either have foals at foot, or the owners be in possession of a "service" certificate.

If 10*l.* a-year were given for each good suitable mare, I fear we should not at first register 1,000; this would be done at the comparatively small outlay of 10,000*l.*; premiums varying from 10*l.* a-year to 30*l.* might advantageously be presented to the owners of all suitable stallions, the larger premium being given to the best and largest T. B. stock, adapted for getting a hunter class of horse, on a descending scale down to the pony stallion fitted to improve the breed of baggage ponies. If we found 200 such stallions in the country, whose owners would be willing for them to serve at a small fee, and which have been serving as such for the preceding twelve months, it would be as many as we should find good and suitable. This could be done at an expenditure of 20,000*l.*, or a total cost of 30,000*l.* a-year to improve the breeding of the all-round useful horse required for military purposes.

The animals for which exemption might be claimed at the time of paying the tax would have to be submitted for inspection, and if found fit a refund order would be furnished.

Many Officers on half-pay, excellent judges of horses, with retired army veterinary surgeons, might be found all over the country, who, on receiving extra pay and their travelling expenses, could perform the duties. Fifty such groups of inspectors might be necessary, as many horses would be submitted for inspection, and large numbers found unfit. This might be done at a cost of, say, 60,000*l.*, with the expenses of two deputy inspectors, one for the north, including Scotland, and one for the south of England, to include Ireland, an Inspector-General with his staff, say, 33,000*l.*, or a total of 80,000*l.*

We should require at least 33,000 horses to be registered to obtain

23,000 effectives for two Army Corps; allowing 1*l.* each for remission of tax and a subsidy, the cost of this would be 33,000*l.*, or a total of, say, 113,000*l.*

If 30,000*l.* were expended annually in premiums for suitable stallions and mares, it is considered that for 143,000*l.* this feasible scheme might be carried out, whilst the horse-tax if renewed should bring in, as it previously did, 450,000*l.*

Arrangements for the breeding subsidy might, if desirable, be placed at the disposal of the Royal Agricultural, the Caledonian, the Hibernian, or other kindred Societies.

The large repositories all over the United Kingdom, being more or less public places, present the space and means for concentrating the horses when purchased, the accommodation being paid for at market rates, thus avoiding any clashing with other Government arrangements in barracks. The animals, which would be classified at the time of registration, would be sent off as soon as possible by rail to their different depôts.

Every horse-owner when summoned to the rendezvous would have to deliver his animal safe at the repository centre.

Thus out of all the hack-horses and ponies at a place like Weymouth say, perhaps half a score of riding, a score of draught horses, and a score of baggage ponies, might be found suitable for the Service; on their being delivered by their owners and purchased, their general numbers would be branded, their description taken, and they would be forwarded—

| | |
|---------------------------|-----------------|
| Artillery to Woolwich. | |
| Cavalry and | } to Aldershot. |
| Transport.. | |
| Engineers to Chatham, &c. | |

Before concluding this address may I be permitted to diverge slightly from my subject—"A Reserve of Horses"—to the general question of "the Supply of Army Horses," which was ably put before you last year in this Institution by Colonel Russell? I regret that my duties on that occasion prevented my taking part in the discussion that ensued. I can bear testimony to the fact that the difficulties of procuring a supply of suitable horses for the Service as urged then are very great, and, in place of diminishing, are annually increasing; there is the gravest difficulty surrounding the subject as it at present stands, our whole military operations, as I have already pointed out, would be delayed, crippled, and paralyzed in case of war for the want of efficient horses.

This want was prominently brought before the nation by Wellington; the same cause almost brought on us a national disaster in the Crimea. Lord Rosebery's Committee of the House of Lords in 1873, after a careful investigation, urged the Government of the day to take some steps in the matter.

The subject was again prominently brought to the notice of the public by Colonel Keith Fraser in an able article in the "Fortnightly Review" for October, 1884. He said then, "It is evident that by

taking every available Government animal it would be barely possible to supply a sufficiency of horses for the cavalry of one such corps," and he added, "there is no reserve of horses."

The insufficiency of our cavalry when ordered to Egypt in 1882 was also prominently brought to notice by Colonel Fraser in the same article, and I may here remark that to complete the small force of artillery then sent out we had to deplete of their serviceable horses almost every battery left at home, whether of horse or field artillery.

Thirteen years since Colonel Valentine Baker, in a lecture delivered in this Institution, urged an increase of horses, and asked for the establishment of a system of reserves to be readily drawn upon if wanted.

In 1884 the late Inspector-General of Cavalry, Sir Frederick Fitz-Wygram, Bart., brought the subject before the House of Commons. He urged an increase in the number of squadrons to each cavalry regiment, and a slight increase in horses has been made.

The present Commander-in-Chief in India, Sir F. Roberts, Bart., drew attention last autumn to the great dearth of army horses.

Supported by the weight of these authorities, it is to be hoped the Government and the country may now take up the whole question. The tax proposed would fall on those who use horses chiefly for their recreation; as a result of such taxation the breed of horses should improve and numbers increase, and the taxpayer would thus indirectly become a gainer, whilst the establishment of horses for army purposes would be placed on a satisfactory footing.

Procuring sufficient men and for keeping up our front line is a simple question of money, so also ammunition, guns, and other supplies are speedily turned out by the aid of machinery, but a sufficient supply of horses is not now procurable, and until a horse is five years old he is not fit for the Service.

I cannot too strongly urge the early initiation of some such system of registration as the one I have brought forward.

If it were at once adopted it would be several years before our own country could supply the requisite numbers. In the meantime, if it is to be placed in anything like a proper state of defence we must look to our Colonies, tap and try their resources, and obtain what we can from them.

A Reserve of Horses.

| | | |
|--|----------|----------|
| Renewal of horse-tax should yield annually..... | £450,000 | |
| Cost of reserve registration and work annually .. | £80,000 | |
| Remission of tax and small subsidy on reserve horses annually..... | 33,000 | |
| Remission of tax and good subsidy for breeding stock annually | 30,000 | |
| | £143,000 | 143,000 |
| <hr/> | | |
| A reserve would be formed, and horse breeding placed on a sound footing, and the Treasury would gain annually..... | | £307,000 |

General Sir C. P. BEAUCHAMP WALKER, K.C.B.: Having read yesterday a copy of Colonel Ravenhill's lecture with very great interest, I turned up this morning the rough notes of a somewhat long Report which I wrote to Lord Rosebery's Committee in 1873, and which I prepared with great care after communication with the Inspector-General of Remounts in Berlin, and with the Civil Statistical Departments which have a special branch for the subject of horses. Before advertizing to the few notes I took from that Report I would remark that, as regards the import and export, I was told by Herr Metzel, who was then the Chef de Bureau of the Inspector-General of Remounts, that a very large number of the horses exported from England to Germany were German horses which had been sent to England and brought back and sold in Germany. He assured me the number was very appreciable. As regards No. 3 of certain proposals which Colonel Ravenhill mentions, I may state that this system prevailed in Hanover, that of short service of horses, and it was found to answer very badly, they came back almost entirely unfit for use. Another point on which I would remark is the fact that very few of our agricultural horses would be of the slightest use for artillery purposes, they are too heavy and clumsy, whereas in Prussia particularly, where the soil is much lighter than that of England, and a much better bred class of horse is used for all purposes, there is no difficulty whatever in taking teams from the plough and putting them into the ranks. I particularly remember at the great parade which took place in Berlin of the Artillery of the Guard before the commencement of the war of 1866, the then General Officer commanding the Guard pointed out to me that three-fifths of the horses had six weeks previously been at the plough, and all I can say is the whole ninety guns marched past and only one horse kicked over the traces. In that country the horses are driven for agricultural purposes in exactly the same manner as they are in the artillery, namely, on the pole, and there is not the slightest difficulty in adapting them to the purpose if required. I thought in looking over my notes perhaps a few points might be valuable here. There are six ways in which in Prussia in 1873 the breeding of horses was encouraged; first by the establishment of three principal breeding studs, viz.: at Trakehnen, in East Prussia, at Neustadt, in the Mark Brandenburg, and at Gradlitz. These were originally established for the purpose of supplying horses to the Royal stables, but since that time they have been very much devoted to the production of stallions for breeding. The second point is the establishment of county studs, I think twelve or thirteen dépôts for stallions, which at stated periods of the year make their round, and return again to their dépôts after the work has been done. The third is that prizes are given for approved stallions, the property of private persons. The fourth, that loans without interest have been made to private associations for the purchase of stallions. The fifth that prizes are given at race meetings—I conclude on the same principles as our Queen's Plates; and the sixth by money grants to parishes for the maintenance of pasture lands for young horses. This is a very small sum, indeed, in fact it only amounts to about 150*l.* a-year. We probably all know that the system in Germany is to buy horses at over three years of age, to let them go to the stud dépôt where they remain at least a year, if not sixteen months, where they are carefully looked after and tended, and are then sent to their regiments, and no horse really enters into the squadron till he is five years old; in the Guards it must be as much as five and a-half years. The remounts at the time I speak of cost the State about 28*l.* The annual waste allowed is one-ninth of the troop horses and one-fifth of the Officers' horses. But by far the most important part of Colonel Ravenhill's lecture is the manner in which he has adverted to the registration of horses which is most carefully carried out in Germany, and was during the whole time of my long service there an object of great admiration, because I had two opportunities of seeing how very quickly a great army could be mobilized under that system. All horses in the country were registered, the only exceptions being the horses of the members of the reigning German houses, the horses of foreign embassies and legations, Government officials who keep horses for public service, and the contractors for the Post Office. There is no great injustice committed by it because everybody is under the same condemnation. The horses are taken at a very fair price, very much commensurate with their real value, and no horses are

taken which it can be proved are of such exceptional value that it would entail a great disadvantage on the owner if they were taken from him. I think some system of the kind might very well be introduced in England, and I hope the lecture we have now listened to may have the effect of drawing attention to the question.

Colonel KINGSCOTE: I had not the pleasure of reading Colonel Ravenhill's lecture but only of hearing it, and I did not quite gather from him at what age the horses were to be reserved, whether at two or three years old, whether they were to come into Government hands first, or at what period of their life they were to be reserved. I do not know whether he will kindly tell me what his idea is upon that. As regards a reserve of horses, there is no doubt it would be a most advantageous thing if it could be done efficiently for the Service, but I am afraid there are very great difficulties in the way of reserving horses, and that when they were wanted they would not be forthcoming in the way we could wish. Giving a subsidy, so much on each horse, might help, but I cannot think that that would bring you any very efficient service, that they would not be fit to put into harness for artillery purposes. Certainly if they were worked in omnibuses and such conveyances you might get them, but then the public would cry out and want their omnibuses just the same whether we were at war or whether we were not. I think the first thing we want is to breed the horses; that is the thing we require, and to which I should really like to see Government aid given. I think that by a comparatively small subsidy very much assistance might be rendered in that way. I should like to see adopted what in a minor way I am glad to think the Royal Agricultural Society is going to undertake, namely, to give prizes for stallions to cover at low prices, the prizes given being 200*l.* a-piece, so as to encourage people to buy good stallions, and to perambulate certain parts of the country covering mares at a low price. That, I think, is a step in the right direction, but then it only occurs in one part of the country where the Royal Agricultural Society is holding its show that year. We want that system all over the country. And I would go beyond that. I would give in future years prizes for mares with foals got by those stallions. You would then give an encouragement to farmers and others to breed horses, and if the money were given by the Government, you might in some way register those foals, and I do not think it would be any hardship to say the Government should have the first claim upon them between two and three years old at a certain price. I have always had an idea that that could be done, and I believe that would encourage the breeding of horses more than anything, and till we do that I am afraid that even giving subsidies and numbering horses for the reserve will not be of very much use. I think that is the right direction in which to commence. Of course as regards Colonel Ravenhill's idea of registration of reserve horses, that might be carried out more easily afterwards, but I am afraid we should be leaning upon a broken reed if we were to trust to that entirely, and not commence by trying to stimulate the breeding of horses.

Mr. GILBEY: I was unfortunately prevented from being present to hear the commencement of the lecture, but I concur with much that I have heard, also with the remarks of Colonel Kingscote. I was speaking on the subject of horse-breeding at a large meeting held in the show ground at the Royal Agricultural Show at Preston, at which Colonel Ravenhill, I believe, was present, and I was met with two or three questions, one being, "It is very well to advocate the breeding of horses, but would the prices at which the Government purchase horses ever encourage the farmer to set about the business?" I replied that the ambition of all breeders should be to produce horses that were much wanted in England, namely, superior sized animals which shall command a ready sale at remunerative prices to the breeder, and that they should be able to look to the Government as purchasers of what I may call "misfits," that is, horses not exactly fit for hunters or for carriage purposes. To my knowledge very many horses that are imported are not such as we can breed in England, but we are obliged to put up with them to meet the continual demand for carriage horses. I cannot quite follow the suggestion that has been made of a Government subsidy, but I am sure it would not meet with favour. We are much indebted to the Royal Agricultural Society for the liberal resolution which they have carried to encourage horse-breeding, they

having voted a sum of money for thoroughbred stallions, to be given at spring shows, five premiums of 200*l.* each and a gold medal. Although the Royal Society has struck a bold line in offering these five premiums, a line that was started by the Hunters Improvement Society two years ago, little good can be done in a country like England unless the example be followed by the other Agricultural Societies. I hope that before long the money now given for Queen's Plates will be devoted to the same purpose, viz., as premiums for thoroughbred stallions suitable for getting half-breeds. The other day I was reading a book, written nearly a century ago, on the breeding of horses, from which it appeared that in one division of Yorkshire alone there were over 100 thoroughbred stallions located for serving mares for breeding half-bred horses. Therefore, unless supported by the Agricultural Societies throughout the kingdom, the attempt of the two societies just mentioned will be but a small one. I am afraid I have said but very little to encourage my friend Colonel Ravenhill, than whom there is no one better qualified, from his practical experience, to make suggestions on this subject, but I will more carefully study and think over his lecture, and if I can be the means of furthering his object in any way or in increasing the number of horses to meet our requirements in England, I shall be only too pleased.

Sir THOMAS GROVE, Bart., M.P.: Sir Frederick Fitzwygram has called upon me, but I am afraid I can throw no light upon this matter. I have been for a great many years in the Wiltshire Yeomanry, and formerly I had the honour to hold a commission in the same regiment with Sir Frederick Fitzwygram. One suggestion that has been made is, I think, well worthy of consideration, viz., that if the money now paid by the country for Queen's Plates in little petty races all over the country was applied to encourage the breeding of horses, which might be available for cavalry or artillery purposes, it would be a very great advantage. These petty races in our country towns do more harm than good: they demoralize the population. Betting men come to those towns, they spend no money there, but go back after having fleeced the poor agricultural farmers, who are far from rich at the present moment. That is one suggestion which I think well worthy of attention. There is no doubt that at present we do not get horses in sufficient quantity or quality to be available for military purposes: what we have are either unsuitable for artillery purposes, or else they are weedy animals that would not be sufficiently strong to carry dragoons in the field, whose weight in marching order comes to 20 stone. Where I live we have a small society which keeps three or four well-bred stallions, the object being to get horses sufficiently strong or sufficiently well-bred to carry medium and heavy weights with hounds or dragoons, or to go into the artillery. One great difficulty is to get horses with sufficient breeding action. It is more difficult than anything in the world to get horses that are really good hacks and have good action for carriage purposes. There has been a very great falling off here; we have been in the habit of getting as stallions broken-down thoroughbred horses, which are no good for races, and which have no action and have not strength enough either to get hunters or sufficient action for good carriage horses. If we could improve that and get a better class of stallions, I am quite certain we should get a much better class of horse to carry dragoons, or to be used for artillery service. I am very sorry I cannot throw any light upon the subject, and I do not exactly know why General Sir Frederick Fitzwygram called upon me, except that I was an old friend of his and held a commission in the Wiltshire Yeomanry as Major and Lieutenant-Colonel. We have some very good horses in that regiment, which is 400 strong, but I am afraid the price the Government now offers for cavalry remounts will not as a rule induce the yeomen to sell their four-year-olds. I know some years ago we had much better horses, but at present we have not enough horses of sufficient quality, as the farmers find it pays better to breed cart colts, as they can earn their keep when two years old off, and a good four-year-old cart colt is worth from 40*l.* to 60*l.*

Mr. JACOB WILSON: I can say with the greatest sincerity I did not come here with the smallest intention of being otherwise than a listener. This is a subject, however, in which I along with my friends Colonel Kingscote and Mr. Gilbey have for some time past taken considerable interest, and for the last eighteen months we have been sitting upon the Special Committee with reference thereto. I feel that

this is a subject which you may have to penetrate very far before you can touch the true origin of the scarcity of horses. Speaking from an agricultural point of view, it must be borne in mind that the diminution in the supply of horses has arisen in a great measure from the improvement by drainage and other processes of the grass lands of England, whereby the farmers of England were enabled to produce beef and mutton more profitably than horses. Matters, however, now are somewhat changed, and I cannot help thinking that with the increased demand for horses it may be in the interest of the farmers to direct their future attention to meeting that demand. I heard the gallant gentleman Sir Beauchamp Walker say that the cart horses of England at present would be of no service for artillery purposes. Well, with all due submission to his greater knowledge, I must submit that there is a class of light cart horse in England, especially in the north of England, of the Clydesdale cross, famous for good shoulders and very good action, and perhaps Colonel Ravenhill will bear me out that in some parts of Cumberland and the Borders such horses do exist. I know from my own experience that such mares covered by thoroughbred horses have produced very good animals, and I myself have sold a horse five years old for 300 guineas, bred from a light cart mare with very good action. What I maintain is this, that the class of mare which perhaps for agricultural purposes cannot be used for breeding Shires or Clydesdales, may with very great advantage be used for breeding something else. I am not prepared to say what. If a man does not breed a weight-carrying hunter he may breed a valuable carriage horse, and if he does not breed a carriage horse he may then have the advantage of falling back upon a supply of remounts, and I regard the supply of remounts as a very great boon indeed to the horse-breeding community of this country. So far as the Royal Agricultural Society is concerned they have, I am glad to say, recognized their responsibilities in this matter, and they feel that it is their duty to give a lead to the rest of the country, in the hope that they may be supported either by the Government or by some other outside source. It is no use waiting for the Queen's Plates money to be given us, or for the Government to make a special grant in the first instance. If the Government of the day see that there is some machinery by which this object may be carried out, they may possibly then be induced to take the matter up, but until we give them a lead I believe nothing will take place. The great object the society has in view is this, to bring into the service of the country a class of horse which at present is not seen—a horse which is a stage above the ordinary scum of the racing stable which is going about the country at this moment, disseminating that which is bad as well as that which is very little good, and also below the standard of the race-horse sire—a class of horse which generally at present is purchased for foreign Governments, and which I think it a great misfortune is allowed to leave the country. It is not for me to tell the military gentlemen present what the great advantage of registration would be. Theoretically it seems perfect, but I am bound to say it does not sound very English. We do not regard parental legislation as a rule with very great favour in this country, and I think that the same feeling would apply to the reserve of horses. I sincerely believe now as a commencement has been made which I hope may be followed up by Colonel Kingscote's suggestion of giving prizes for the produce of these valuable horses, which I believe will be purchased by special individuals for the special purpose (and even at high prices) as a good investment, that the result will be a very great improvement in the supply of horses for cavalry, artillery, and for general purposes.

The CHAIRMAN : Surgeon Lambert is with us to-day, and perhaps he can tell us something about the Irish horses, a point in which the cavalry are most concerned, because they are very good riding horses, though they have very few draught horses.

Inspecting Veterinary-Surgeon LAMBERT : I did not come prepared, Sir Frederick, to speak on the subject, but I was first in Ireland in 1859, and then we could get cavalry horses for 25*l.* and 30*l.* quite as good as they are now when the price is 40*l.* and upwards. I was associated with General Sir Drury Lowe, the present Inspector-General of Cavalry, in buying horses in the north of England in 1878, at the time of the so-called Russian scare. There we had to buy all sorts of horses, and one point that struck me, which I think has not been touched on to-day, was that

had we been able to give for the horses we required 5*l.* or 10*l.* more, we could have got at least three times the number we did. We had the same experience in Dublin in 1882, when in response to advertisements large numbers of horses were brought to the barracks, but the owners refused to sell scores and scores, just for the sake of 5*l.* which they wanted more than we could afford to give, or rather more than was the Government limit. I think in time of war or emergency, when large numbers of horses are required, it would pay the Government to give a little more money than they have hitherto done in such circumstances, and then they would get far more horses than they otherwise would.

Mr. GILBEY: I omitted to mention one fact alluded to by one of the speakers, who mentioned the superior quality of the German farm horses for military purposes. I do not know whether he takes the type of the English cart horse from the horses seen at our London spring shows, which are the heaviest and the best we possess in England. Very much depends upon the soil where the horses have been bred and located; the shire horse reared upon light lands soon becomes a smaller and more active animal, possessing at the same time the good quality of bone, well-formed flat legs and sound feet. I should like to have the pleasure of showing the gentleman who doubts the activity of our shire horses, two animals that I keep in the country for station and carriage work. It may be thought strange that I should use cart horses for that purpose, but I prefer them to the foreign horse, which is only too frequently soft and unfit for quick work, for they can do with the greatest ease nine or ten miles an hour, and that day after day. There are many hundreds of light mares in the country of precisely the same type, and what I maintain is—I have expressed these views in a short pamphlet on the subject—that if these mares are carefully selected and mated with a good sound thoroughbred horse, they will produce the class of riding and driving animals so much wanted in this country.

Colonel PHILIPS, h.p. 4th Hussars: I can support what the lecturer has said with regard to the scarcity of horses, for having had the command of a regiment for the last four years I find we are utterly unable to get horses over three years old, and consequently the country is put to the expense of those horses being fostered and kept in our stables with all the risk and chances of their not maturing. I know from talking to farmers and asking them why they do not breed horses that we can buy, the same answer has always been given to me that it does not pay them at the price that we give. When we sent two cavalry regiments to Egypt in 1882 nearly all the other regiments were unhorsed. I know I gave 100 horses myself and, taking my remounts, the result was I had about 150 left for parade. I had to buy remounts, and I suppose for every two four-year olds that I bought I had to buy 28 three-year olds, and although we did not buy the three-year olds until October, still they were fit for nothing until the following spring. If any of our regiments were ordered into the field we should find to bring them up to a war footing that we required at once 200 or 300 horses, and they are not to be got. I was on the Central London Committee in 1882 with Colonel Ravenhill and Sir Frederick Fitzwygram, and I know that although we were giving 50*l.* or 60*l.* we could not buy 100 horses. The figures that have been given to us to-day show that the horses are not to be got in the country, and I doubt whether except by compulsion you could buy them at all. Of course if all the horses were registered, we might know that we had them in England, but still as no one keeps extra horses, people would not like to part with them even if they were paid 100*l.*, and if you give only 40*l.* or 50*l.* the horses simply would not exist. I know that the whole time that I have commanded a regiment I have had to buy three-year olds and to make the best I could of them. I therefore entirely support what the lecturer has said as to the scarcity of horses.

Lieutenant-Colonel INGE, late 6th Dragoons: I came here, Sir Frederick, for information, but as you have been good enough to ask me to give my opinion I may say that I think the registration of horses would be a very difficult thing to carry out in this country, for the reason that the people whose horses you would register would be a class of people who would always be changing horses, so that you would never be able to get at them. As a matter of horse-breeding in this country the great thing is to prevent the foreigners coming over and buying all our good mares. As I am in the habit of attending most of the fairs in England it seems to me that

there are plenty of horses to be bought, if the Government would pay the price for them, but the great thing is to prevent the foreigners, Messrs. Oppenheim and others whom I could mention, who come over and buy every mare and give a good price for them and so tempt the farmers to send them out of the country. I have a friend on my right, Mr. Martin, who has a large ranche and a quantity of American horses, and who I daresay would be able to give you more information than I can.

MR. MARTIN: I have been listening to this discussion with the hope of hearing something said upon a point upon which I am at present profoundly ignorant, and which strikes me as a most important point, namely, whether horses are to be got in this country at all. If they are to be got in the country, I am not in the position to make a speech to show you how they can be got from another country, because in that case I might be supposed to be acting in an antagonistic manner to the British producer. The question first to be decided is whether cavalry horses can be got at the price that the cavalry pay in England—first of all whether they are bred, and if so whether the people who breed them would part with them at that price. If I am justified in assuming, as I think I am, from one or two speakers who are evidently acquainted with the subject, that horses are not to be got, then I take a very strong ground, and I say that it would be very much better that the money of the English Government should go into the hands of their own Colonists than into the hands of foreigners. The whole question is bound up with that question of federation upon which you had a very excellent paper read only a few days ago—the Federation of the Colonies for mutual protection. Some six or eight years ago I was hunting buffaloes on the Foot Hills of the Rocky Mountains; I there found a very beautiful country, and I told members of the Canadian Government at the time, “this country is destined in the future to supply the remounts for the English cavalry.” At the time I was looked upon as a madman; the winters in that part of the world were extremely severe and the whole thing was thought quite impossible. However, I was very much struck with the idea myself and I put it into execution. I have now got a couple of hundred horses running loose on the mountains, and I have also sent out some English thoroughbred stallions. I am not in a position to boast very much of the result at present, as I had to start with native mares, but they at any rate have certain qualities which would be peculiarly useful for cavalry purposes. They are not at all particular what food they get, they will eat anything they can pick up by the wayside and will stand an enormous amount of fatigue. They have legs and feet such as no one who has not been out of England could believe to exist; the feet are so hard and flinty that you cannot cut them with a knife, and their legs are something to dream about. But they have all the drawbacks of irregular breeding, they have a good deal of original barb blood, more than doubtful ewe-necks, heads put on wrong shoulders, in fact all the good and bad points of the barb, but of course it is a question for breeders who know the right way to breed whether by crossing them with really good horses you would ever be able to get suitable stock for cavalry purposes. My own opinion is that, given a naturally fine horse climate, it is really only a question of intelligence to be able to breed whatever you like. Whether one man's life is long enough to do it in is another thing. But one point which bears upon the question more particularly from my point of view is this, there must be some reason why the price of cavalry horses should be kept down to a very low point, I assume that there is a reason. A previous speaker who has bought largely in past years for the cavalry in England says that not many years ago they were to be bought at 28*l.*, and now you have to give over 40*l.* That is a very important question. Land in England is extremely valuable, the fee-simple varies from 25*l.* to 100*l.* an acre, and when you breed horses on valuable land they have to bear their share of rent and expense of production. I can quite conceive that except on the most inferior classes of land in England you could not breed horses and sell them as four-year-olds at 40*l.*, but if you cannot breed horses in this country at the price, you must then see where you can get them from or you must increase your price. If the price cannot be increased for practical reasons, and the supply to be obtained in England is not likely to be increased, and you have to look elsewhere, I merely suggest that you should look to the Colonies because we could produce them at the price, and I think it is merely a question of

taking the trouble in order to produce the animal required. I could myself at the present time land a four-year-old horse between 15·2 and 16 hands high in London, and anything that I got over 15*l.* a-head would be net profit, which is rather an important point. I hope that nothing I have said will deter anybody from making efforts to carry on the most magnificent breed of horse in the world—the horses that are bred in England, such horses as are not bred in any other country, weight-carrying hunters, and so on; but I do really think if it comes to this point that we are likely to be absolutely without cavalry horses in the time of need, that there are parts of British North America which could supply the article required at a reasonable price and deliver them in immense quantities in England within fifteen days. What the importance of this from the military point of view is you are better able to judge than I am; the price at which they could be produced would be such that everything over 15*l.* or 20*l.* would be net profit, and of course people breeding horses in a large way as a matter of business would take very much less profit per head than the farmer who, only breeding two or three in the year, would naturally expect to make something out of them. I think that is all that I can contribute to the discussion.

Major-General GOODENOUGH, R.A.: May I ask Mr. Martin what are the sires from which the native stock of mares of which he has spoken have sprung?

Mr. MARTIN: I think it is generally admitted that there were no wild horses indigenous to North America. It is supposed that the Spanish cavalry under Cortez when they came and conquered that continent let their cavalry horses run loose on their return home and that that is the origin of the present breed. Those were presumably barbs. At any rate the typical mustang that you have read about, but very seldom see, presents all the good and bad points of the barb—just what you would expect if the barb had been allowed to run wild for 200 or 300 years and breed promiscuously. Horses under such circumstances always have a tendency to degenerate. As civilization reached the west the best and biggest of those mares were caught and mated with the Kentucky stock which the Americans at that time were doing their best to develop. I do not think Americans have the most elementary notions of horse-breeding, and beyond putting a little more bone into the original wild stock I do not think they added in any way to their attractions. Later on there were a few English thoroughbred horses out there that were really good horses, and it was seeing a few colts got in that way that led me to try my experiment. I do not wish to say too much about it, I am not sanguine about it, you want two or three generations to carry it out. I got the best of these wild mares, I picked them as big as I could, drafted them off carefully, and by that means got the best brood mares that I could. I then put to them large half-bred sires, what you would call in England good-looking 16 stone Irish hunters, stallions, rather cobby horses but with plenty of bone and good shoulders. The shoulders are the weak point. The result is I am now getting more mares bred in that way which are admittedly the best in the country, but how they would compare putting them alongside English horses I do not know; you would probably call them very ugly. They have most marvellous powers of endurance. A man weighing 20 stone rode one of these horses 280 miles and back again within six days, out of which he spent one day in doing his business. The horse was under 15 hands high, and the only food it had was what it could pick up from the grass, it was a long journey and good water was scarce in places. These horses have extraordinary powers of endurance, and can do, as I say, an immense quantity of work on very insufficient food. I think in a year or two's time I shall be justified in bringing over a cargo of these horses as an experiment, and seeing what they really will fetch, for I think that a person's opinion about his own stud is not as a rule a very reliable one.

Lieutenant-General Sir MICHAEL BIDDULPH, R.A.: I am sorry I had not the opportunity of hearing the lecture, but I know generally the arguments that have been used. From my own experience of the tremendous losses that take place in a prolonged march and in the operations of war, and of the difficulty that there is in finding a sufficient number of horses in this country ready to equip an army, I think it is necessary that some steps should be taken in the direction which Colonel Ravenhill has pointed out, to arrive at some means for providing a reserve of horses, or of improving the breed of horses in this country. During a long residence in

India I have assisted by counsel and also by serving on Committees in improving the breed of horses, and during the last twenty years in which I have attended the fairs in the north of India I have noticed that there has been a very great improvement in the stock and in the colts and fillies which have been produced, due to the selection of the mares there being branded according to the different class for which they are considered suitable. In fact they have gone down so far as to arrange which kind of mare should be suitable for breeding mules, but with that just now we have not to do. The idea has been prevalent in India, and I have advocated it, that the stock should be purchased young, and that there should be grass-runs where the young stock could be kept and prepared for the Service. What I have to say is this, seeing what very great difficulties have taken place in purchasing at short notice a sufficient number of horses to equip an Army Corps, it is necessary that some steps should be taken to secure the reserve advocated by the lecturer. I am sorry I cannot throw any further light on the subject, but there must be many gentlemen here connected with this country who can discuss the point, and suggest means which I am not capable of doing.

The CHAIRMAN: Gentlemen, the first question that strikes me is the supply of horses in this country, in other words the number of horses in this country. I believe there is an ample supply of horses in this country, ample in point of numbers, and as to draught horses ample in point of quality; but the question is not how many horses there are in the country, but how many can be purchased, that is to say, how many surplus horses there are over and above the absolute requirements of the trade of the country? Of course, you can buy a horse when a person is willing to sell a horse, but when, as in the case of war, the country is drawn upon heavily for horses, you will find people will not sell their horses at any price whatever, if they lose their trade by so doing. You can always buy 4,000 or 5,000 horses in this country without very much trouble. I think I may say during the Egyptian War we had no very great trouble in getting about that number of horses in the country. Colonel Ravenhill says we took eighteen weeks about it, but the fact is the Government were rather chary in finding money, as they were not certain whether the war was going to last. The question is, how many horses can you buy? In the course of the investigations made by the Committee which I was on, we made various inquiries, amongst others we referred to the London Omnibus Company. That company has 8,000 horses, and they said they could afford to sell about 2 per cent. of them. Doubtless, if we had offered somewhat more than the horses were worth, we could have bought a considerable number from the London Omnibus Company, because they could have replaced those horses easily; but supposing the country was pretty well drained of horses, they could not be replaced, and I believe you would very soon reach a point at which you could not buy horses at any price whatever, because people will not part with that which is essential to their trade. I think one of the gentlemen who spoke said that if during the war we had given a few pounds more for horses, we could have got a considerably increased number. Possibly at the outset of the demand you might, but my belief is, that when you have once drained the market of the surplus horses, no matter what price you offer for the horses, you will not be able to get them. To revert again to the London Omnibus Company, they could sell you as many as they could afford to sell, as long as they could replace them; but their trade lies in those horses, and they will not sell what is essential for the purpose of their trade for any sum of money you might offer. I feel convinced myself that the difficulty in mounting the cavalry corps rests, not in the insufficient number of horses in the country, but in the impossibility of buying those horses, and I believe very much the same difficulties occur in every foreign country. We very often hear that there are horses to be bought more cheaply in one place than another, but I think you will find that neither in foreign countries, nor at home, are any large number of horses kept over and above what the trade of the country requires. We do not want unbroken horses for the purposes of war; we want horses 5, 7, 8, or 9 years old which can be put into harness, and worked at once. I believe that the number of horses which you will find in any country in the world over and above the requirements of the trade of the country, are, comparatively speaking, few, and hence I look upon it, that you will have the very

greatest difficulty in getting any large number of horses under any purchase system. The Germans do it by registration, they do it by taking horses when they want them. The Indian Government possibly might take horses when they want them, but in a free country like this, it would have to be a question of buying the horses from the individual owner. Something has been said about the registration of horses, and I believe one or two gentlemen have said that would be a fallacy, that you would not get the horses when you wanted them. You could not go round, and have a monthly inspection to see whether the horses were there or not, and as this is a free country, and people buy and sell their horses when they like, I look upon registration as a pure fallacy. Now, about the number of horses in this country. I think Colonel Ravenhill agrees with me that the great failure in case of war would not be with regard to draught horses, but riding horses. The trade of the country is increasing year by year, and, therefore, probably the number of draught horses is increasing year by year. There are many more draught horses in England in this present year than there were in 1876. But the number of riding horses I believe to be steadily decreasing, and the reason is because farmers and other people who used to ride to market, and ride about the country, now nearly invariably come in by train or drive. In the neighbourhood in which I live there is a very good-sized market, everybody either drives in or comes by train. I don't think there are half a dozen farmers who ride into market at the present day, whereas forty years ago 90 per cent. of them came in in that way. Another reason why riding horses are falling off in point of number is this. The public as a rule are not very good judges whether a three-year-old is likely to prove what they want when it becomes five or six years old, and the larger and coarser horses that show a good deal of size and bone at three years old are what the public as a rule will give the most for; and consequently they are what breeders endeavour to breed. I am sure Mr. Lambert will agree with me that in Ireland you can buy horses best suited for troop purposes for about 25*l.*, while the coarser animals fetch readily 35*l.* or 40*l.* in the market; and that being the case, the breeder will look, not to the ultimate value of the horses, but to what will answer his purpose best to breed for selling at the earliest date at which you can sell the horse. There have been several questions raised about the price of troop horses, and whether the cavalry give a sufficient price for them; I need not tell you that neither the cavalry, nor anyone else, will give more than what they can get the article they want for. I am under the impression that, as a rule, our cavalry regiments are well mounted, and that being the case, I don't see that the Government require to give any higher price than they are now giving, but I am going to ask Colonel Ravenhill whether I am correct in stating the price which is paid to the farmer by the contractor for the R.A. and R.H.A. horses has not been always very considerably under the contract price, or, in other words, the price which the contractor receives from the State. I am perfectly prepared to say, speaking of some few years back, that having gone very frequently to the Irish market, and having selected horses which I have sent the dealer to buy (because that is the best way of doing it), that in the regiment, before we went to India, the average price paid in Ireland by the dealer was not above 25*l.* at the outside. The Government paid 40*l.* Therefore, it is not so much the price given by the Government, as the fact that the dealer would buy the horses as cheap as he could. And I think I may say as regards three-year-olds and four-year-olds that the Irish farmer looks upon the troop price as about the best price he is likely to get for what is known in the Irish market as the "long-tails." That being the case, I don't think any increase in price would be of the slightest possible use as regards troop horses. A statement has been made that farm horses are too heavy: I don't think you can help that; the fact is the horses in a county become heavier or lighter according to the soil and the grass. Nothing that you breed down in Lincolnshire would prevent the horses getting heavy, while if you breed in Ireland, nothing will prevent them becoming light and well-bred. I, therefore, do not think much can be done in the way of getting more riding horses in that direction. There have been several remarks made about the value of good stallions taken about the country. There are two sides, however, to that question. If the Government are giving subsidies to one class of stallions, they will starve other and pretty good horses out of the market, but still, I believe, it would be an advan-

tageous thing if a premium were paid to every stallion travelling the country, which the Board of Selection in the district thought worth keeping for breeding purposes, and it should be a condition that the horse stood for service at a moderate sum. Practically the Government certificate that he was a good sound stallion, and that owing to the Government subsidy he could serve mares as cheaply as the commoner brutes going about the country, would be very useful to the breed of horses. I am afraid that you will find that all through the country the cheapest stallion is the one employed. If you have one at 20s., and another at 40s., nearly all the trade goes to the one at 20s. It is an evil, and the only remedy I can see would be to subsidize the good stallions, so that they might offer to cover at the same price as inferior animals. Mr. Wilson made a very sensible remark, namely, that the reason why horse-breeding had fallen off was because, on account of the drainage of land and other causes, it was possible to rear beef and mutton more profitably than horses. I believe that is a great cause of the alleged failure of the breeding of lighter horses. Farmers will do what is most profitable, and they would be fools if they did not; it is absurd to expect them to do anything else; but I quite think now that beef and mutton have gone down considerably, and horses have gone up considerably, that, therefore, we may look to a more active breeding of horses. It has been suggested that an export duty should be put upon good mares. There cannot be a greater fallacy than that. If you want to discourage breeding, put a tax on the export. No man in his senses would think that good breeding, or a good race of horses, or a numerous race of horses could be propagated in a country by extinguishing the best demand for those horses. Some gentlemen have alluded to the value of the army demand for horses. A regular demand for horses, of course, is of value, but an irregular demand such as the Government would have to make on the outbreak of war or anything of the sort will never lead to breeding horses. It is a casual demand, and I believe whenever a war breaks out, you will have to resort very largely to foreign countries for the horses you want, because nobody will breed on the chance of a demand which may not occur once in twenty years. The Committee which sat some time ago, of which I was Chairman, recommended very strongly that all foreign markets should be tried. We often hear very wonderful tales about what foreign horses can do. There is scarcely a person comes home from abroad but says that in the particular Colony in which he has been, the horses do fabulous distances, and on very little food. I do not say in all cases the statements are erroneous, but I have seen something of foreign countries, and I am prepared to express my opinion that the value of many of the foreign breeds is exceedingly overrated. I have owned some of the best Arabs in India, but I have never known an Arab which would do a long day's journey as gaily, and come in as well, as a very ordinary Irish hack that you can buy for 25*l*. In illustration of what I have said, some years ago, when I was first Inspector-General of Cavalry, there was a Hungarian Committee which came over to London and offered to find 10,000 horses to be delivered in the London Docks at 38*l*. a-piece, to be only accepted in the London Docks. They were guaranteed to be 15·2, and generally five or six years old. At that time there was a ring formed by the Irish dealers who said that they could not find four-year-old horses, and they doubted whether they could find three-year-olds of good quality at Government prices. As I knew that to be pure nonsense, I recommended the Adjutant-General to accept the offer of the Hungarian Committee so far as buying a certain number of these Hungarian horses. Eventually a Committee, of which Mr. Collins, P.V.S., was one, was sent out to Buda-Pesth to buy 700 horses. What was the result? Instead of being able to get 10,000 horses all warranted 15·2, five and six years old, the Committee stayed there two months or two months and a half, and they brought home not 700 but 430 horses, very few 15·2, most not over 15·1, a considerable number 15, and some 14·3, and that was all they could get with two and half months' hard work in a country in which they were told they could get 10,000 horses all 15·2. The Government are going to send out to try the Canadian market, but I am afraid Mr. Martin won't have his horses ready by that time.

MR. MARTIN: Not at the price. I can sell everything I breed on the spot locally at 200 dollars.

THE CHAIRMAN: I understood you to say you could land them for 15*l*. at Liverpool.

Mr. MARTIN : I could sell them in England for 15*l.*, and everything I made over that would be net profit ; but that does not affect the fact that I have sold all I have bred on the spot for 200 dollars.

The CHAIRMAN : Colonel Ravenhill has made a proposal to carry out a scheme which consists largely of a scheme for the inspection of reserve horses, and he expects to get the money to defray the expenses of his scheme of inspection by putting a tax upon horses. His figures no doubt will bear out what he says, but I think any tax on horses would be beyond all question an evil ; I am quite certain it would do more harm than good. I do not think a system of reserves can be carried out for the reasons I believe I gave at first, namely, that you find people change their horses and you cannot inspect them sufficiently often. The yeomanry have been spoken of as a source of possibly remounting the cavalry. Well, I am afraid you will find a very large proportion of the yeomanry are not the owners of the horses which they ride, and that being the case, you would not get very much out of them. One or two remarks have been made on Government breeding and Government studs, and the value of that. I believe the experience of all Government studs is that they are a failure. Breeding is a specialty, and you require a body of men who can mate horses and mares together. It is a specialty, and when you are dealing with Government money, you are very likely to go on with a man perfectly honest and conscientious, but who does not possess the specialty, and the consequence is it will be a failure. It is also a failure for another reason, namely, the cost of breeding in studs where you have to pay for the food is exceedingly great. The Irish breed of horses is mainly produced by the small farmer class. He is a man with seven, ten, or twelve acres. He keeps an old mare for plough work ; the mare is covered every year, and there is a foal ; the foal runs about the grass and practically costs him nothing till it has become three years old, when he gets 25*l.* or 30*l.* for it, and he thinks he is exceedingly well paid. But the moment you keep horses and feed them in excess of the leavings of a farm, you will find their expense very much larger than 30*l.* The Indian Government many years ago had a very large horse-breeding establishment. I dare say many gentlemen who have been in India know what the Indian studs were. When I was in India some years ago the Government asked me what I thought their horses cost. I went round one or two of the studs, and I said I thought they cost upwards of 100*l.* a-piece ; that seems rather an astonishing amount of money for a remount. Years rolled on : I came home, and when I went out again I found they had had a Committee on the Indian Remount Establishment. They had appointed two Officers who were in favour of the studs and who wished to keep down the cost as much as they could, and two who wished to run up the cost, and an umpire. Those of the Committee who wished to keep down the alleged cost had to admit an average cost of 135*l.*, the others ran it up considerably more, and I believe you will find almost all horse-breeding establishments are and must be, for the reasons I have given, if not a failure, at least exceedingly expensive. I must confess I look upon this subject, notwithstanding Colonel Ravenhill's lecture, as one in which I am almost in a state of despair. I do not see how we are to get the horses we want for the purposes of war. Colonel Ravenhill has not at all exaggerated the number of horses an Army Corps would require ; in fact, he takes it at about the lowest estimate. It is quite certain we cannot get those horses in this country ; I have great doubts whether we could get them in any other country, unless you do as foreign countries do. If you like to stop the traffic in Regent-street and single out and appropriate all the horses that pass down, of course you will get your horses for an Army Corps ; but while it is as at present, I do not see how we are to meet the want of horses for war.

Colonel RAVENHILL : After what has passed, I shall keep you a very short time. Colonel Kingscote was good enough to remark that I had not stated the age at which the horses would be registered or bought ; that is a matter of detail I did not enter into in the paper, because I say in it they would be registered if found fit. Of course no horse, unless he is of a fit age for cavalry purposes, would be registered. You would not register a small thing two or three years old ; you would register nothing till it was absolutely fitted for cavalry purposes, and then I should propose to subsidize them. With regard to omnibus horses, of course they

are most valuable. The horses that ply for public hire about the country are well seasoned, well kept and fit for work, and those are the horses we want to get at by some means. Of course if we get an Act of Parliament to press every horse in the country, we know that there are heaps of horses in England, but no one wants to see the London carriage horse and the horses out of the different conveyances in Regent-street taken up. It is to provide in some other manner for this in an equitable way that I have made my proposition to-day. I think, on the whole, that this paper has conduced to a satisfactory expression generally. I knew perfectly well when I thought of making public such an idea as reimposing the horse-tax, it would meet with opposition from some—how could it be otherwise? But unless some measure is taken, it is impossible to say to what straits we are not coming in the matter of horse supply, not only for the Army, but for the country in general. Several gentlemen who have been kind enough to address the meeting to-day—Mr. Wilson, Mr. Gilbey, Colonel Kingscote, and others—can bear me out that nothing I have said here to-day is too strong to impress on the public the absolute necessity of something being done, and I do hope that this paper and the discussion of it may lead to a some feasible outcome. There is one other point I should like to touch upon, that is with regard to the prices to be paid. Sir Frederick Fitzwygram spoke of the prices paid by the contractor. It is true the contractor used to pay a very much smaller price than he received. I take it now that the contractors do not get quite so much out of it. It must be remembered, although the contractor makes his own arrangements with the farmer and breeder and gets a higher rate from the Government for the horse he delivers at the depôt, still that difference in price is an insurance on the part of the Government that the contractor shall provide the horse safe and sound, shall deliver him all right, and in case of the horse having to be returned, the contractor has to take him back. The farmer could not possibly take up that risk. I have been all over England, and have had men buying for me in Norfolk, Devonshire, Yorkshire, Wales, and I have gone to a fair in Ireland where I have found them and other dealers from all parts of the globe congregated and bidding one against another. It is not that the horses are bred and produced in Devonshire, Norfolk, and so on; but the fact is that these very horses that the men show to me as the produce of their own county are bought wherever they can get them, and nearly all the well-bred horses we see about the country in England come from Ireland. There are very few horses bred in Yorkshire. I hope the breeding will improve, that the numbers will increase, and that what the Royal Agricultural Society has been good enough to do will have a good effect, but more money is wanted than they could possibly afford to give. I am extremely obliged to you for the patient way in which you have attended to this paper, and to the Chairman for having so kindly presided.

The CHAIRMAN: Gentlemen, it only remains for me to ask you to give a very cordial vote of thanks to the lecturer for what I think I may call his able and instructive lecture on this very difficult subject. If Colonel Ravenhill cannot show very distinctly how he would provide a reserve of horses, I do not think the failure rests with him, but in the difficulty of the subject. I believe he has put forward his views extremely well, and I hope that something may come out of them. I think you will all join with me in thanking Colonel Ravenhill very heartily.

Wednesday, June 9, 1886.

GENERAL G. ERSKINE, Vice-Chairman of the Council, in the Chair.

THE NECESSITY FOR A PARTIAL ENFORCEMENT OF
THE BALLOT FOR THE MILITIA, AND ITS BEARING
ON THE REGULAR ARMY, THE YEOMANRY, AND THE
VOLUNTEERS.

By Major A. D. ANDERSON, R.H.A.

UNDER this heading I purpose inviting attention to the Militia, the Force maintained by the nation for home service, the backbone or foundation of any system of local defence, upon the condition of which much of the efficiency of the Regular Army, the Yeomanry, and the Volunteers should or could be made to depend.

I cannot but approach this subject with caution and almost surprise at my own rashness, when I recollect how ably the question has been treated by numerous members of this Institution, and when I study the valuable Report of the Committee which sat on the Militia in 1877; but I am emboldened when I notice that there runs through all the published utterances an indirect, and in some cases a direct confession, that after many years' experience, during which every conceivable remedy has been suggested and tried, the Militia as at present existing is neither complete nor sufficiently efficient; that many give these attempts up as a bad job, and boldly express their opinion, that as at present organized it is futile hoping to get the Militia up to the required standard of efficiency, and that recourse must be had to the Ballot; while the Militia Committee of 1877 conclude their Report with: "but we venture to point out that time and preparation are such material factors in modern wars, that without some previous organization it would be practically useless to revive, or even to recast, the laws affecting compulsory service."

Momentous words these, penned by a body of most experienced and highly responsible Officers, but as in time of invasion we would most certainly "revive the laws affecting compulsory service," it would be better to have the previous organization they speak of prepared and adopted now than wait for a time of emergency.

The Ballot Bill of 1860 stands as one of the Statutes of the land, by which the enrolment of all males over 5 feet 2 inches in height, and

between the ages of eighteen and thirty years, is provided for, and admits of the whole or part of these being taken as required.

This Ballot Act is, however, annually held in abeyance by Act of Parliament, and Forces dependent on their popularity with the masses, as is the Militia, continue in their normal state of unpreparedness.

One feels almost ashamed to repeat the hackneyed cry of "Prepare," but we find it in the mouth of every soldier or sailor who reads or thinks, and who has the honour and safety of his country at heart.

We need, for an illustration of the fate of such unpreparedness, go no farther than the campaign of 1870-71, where we saw the fairest provinces of France devastated by war, nobles and peasants alike sacrificing their lives as simple volunteers in the ranks, in a fruitless endeavour to retrieve what want of organization and preparation on the part of the State had entailed on their beloved country.

Such would be the case with England if invaded by hostile foes; thousands of all classes would gladly and proudly volunteer their services, but they would be but a courageous armed mob, with whom it would be practically impossible to achieve anything, owing to want of previous training, and they would be annihilated by regular troops, as were the Garde Mobile of France by the organized forces of the German Empire; while money would be made to flow like water, to, if possible, remedy what would then probably be irremediable.

It is therefore, I submit, a duty of the first and most urgent necessity that a law shall be enacted to place at the disposal of the military authorities the means, the men, and the power of organizing an ample Force for national defence, and these authorities should be held responsible for the thorough efficiency of this Force, as they at present are for that of the Regular Army.

The military authorities have now to take what they can get under voluntary enlistment, and make the best they can of it; and so averse is the Nation, and many Officers of Militia themselves, to conscription, that they would rather go on in an incomplete and insufficiently efficient state, than face the only remedy.

Assuming the advisability, even the necessity, of a large Militia Force for home defence, and in view of the fact that there is at present an annual expenditure on it of 1,348,100*l.*, it is right and fitting for us soldiers to consider its present efficiency as a military machine, and it is from the point of view that "the Militia as at present raised and trained, does not sufficiently represent the nation, or offer a safe groundwork upon which in time of attack from abroad, the remainder of the Regular Army, the *Dépôts*, the Yeomanry, the Volunteers, and all rapidly organized levies could be grouped and formed for systematic defence," that I invite you to consider the question.

In discussing the fitness of the Militia to fulfil its mission as our "first line of internal defence," we must commence by dismissing from the calculation any hope of support in time of war from the Regular Army.

Past experience has convinced us that a European war, requiring the maintenance of two Army Corps in the field, in addition to supplying the wants of India, would drain the country of all Regulars and

Reserves, and necessitate the use of the youngest, last-joined recruits in the ranks of our battalions in the field; it also teaches us that the Regular Army left in Great Britain after a short continuance of a foreign war, would, instead of being able to furnish regiments for internal defence, consist of nothing but recruiting depôts, and would rather look to the Militia, and draw upon it for a supply of partially drilled and suitable men, than be able to contribute any appreciable forces for local defence.

As has been before said in this Institution, "the presence of the regular troops may be, in the first moment of invasion, considered an accident, and their functions should be of manœuvre, as a reserve, to consummate the defeat prepared by the resistance of the Militia, to which we must now add, of the Volunteers."

But I would go further; the Regular Army would more than likely be occupied abroad, and for its probable condition and that of the depôts remaining behind, we need no better illustration than the Army in the Peninsula in 1813, and its means of being reinforced in England. For the sake of exemplification we will take the three regiments best situated, and the three worst off, at that time:—

| Corps. | | Wanting to complete | Means of re-inforcing the regiment. | Rank and file for immediate service in depôt. |
|------------------|----------------------|---------------------|-------------------------------------|---|
| Three best off. | 5th Foot, 1st Battn. | none | 2nd Battn., Exeter | 344 |
| | 7th " " | none | 2nd " Jersey | 326 |
| | 91st " " | 86 | 2nd " Ayr .. | 362 |
| Three worst off. | 74th Foot..... | 531 | Depôt, Carlisle | 10 |
| | 2nd " 3rd Battn. | 486 | " Battle..... | 32 |
| | 30th " 2nd " | 456 | " Hull | 16 |

Or, a shortcoming of 12,609 men wanting to complete establishments on a force of 68 regiments, and 6,480 men in England to meet the demand; this is leaving out of the question sick, 18,151.

It is therefore evident we must, under such conditions, dismiss from our thoughts any hope of expecting material assistance from the Regular Army, should England be invaded while we are engaged in a foreign war.

Thus the nation having only its Militia, Yeomanry, and Volunteers to depend on for national defence, should not rest content with half measures, but insist on such laws being passed as will leave no possibility of these Forces being ever found otherwise than in the most thoroughly efficient and prepared state.

This I submit is not now their condition. It is true that the Ballot Act, if enforced, would in time of war give us, as regards numbers, all we require, but it would then, in the moment of our greatest trouble, and possibly peril, give us but raw recruits with which to defend our hearths and homes. This state of affairs has been brought about,

not by supineness or neglect on the part of the Officers responsible for the Forces, but because the true foundation of internal defence, viz., that every sound man between certain ages is available for the defence of his country, has, in the Militia of to-day, been allowed to stand in abeyance; the State fixes the numbers required, and the pay, and takes what men are pleased to come. This has resulted in the standard being lowered to 5 feet 3 inches, and a 32-inch chest for lads over twenty years of age, and for those under that age to 5 feet 2 inches, and chest at discretion of examining medical officer; and therefore to the Force being far below an average specimen of our race, as regards size; to its being always from 20 to 25 per cent. under strength, or roughly, deficient of about 30,000 men on a total of 142,000; to a large deficiency in the complement of Officers; to about 25 per cent. of those enlisted not being forthcoming at the annual training; and to the standard of shooting being dangerously low,—while portions of the kingdom furnish heavy drafts for Militia, others supplying none, or next to none, and owing to the facility with which men can withdraw their names, to the possibility of their being absent, and to the numerous difficulties attending their training, no really fair standard of efficiency can be expected from them as a body.

This all arises from the good old fundamental rule of general liability for Militia service having been gradually lost sight of. So distasteful is "conscription" to our race, to men preoccupied with their business, their pleasures, everything except thinking ahead of the necessity for providing for the defence and protection of the same, that they are glad to shun the subject, or argue, "Let us pay more and get what we require;" but I submit it should not be so; we should pay for what is deemed necessary in the Navy or Regular Army, and for the requirements of efficient Yeomen and Volunteers, but there draw the line, and rigidly enforce the principle of universal liability for service in the Militia, for purposes of internal defence.

Without going so far on the one side as an Officer who writes—"All I can say, gentlemen, is that I should be proud to command such a force on any service, and I feel sure we should not get licked;" or as another, who, when speaking of the Militia being supported by voluntary enlistment, says—"And I think it the great glory of Old England that such is, and is likely to continue to be, the British system of our day;" very admirable sentiments, if capable of proof; nor upon the other side, as a third Officer, who, writing of the Militia, describes them as "in peace a charge, in war a weak defence,"—I shall, I feel certain, be expressing the opinion of the mass of Officers, Regular or Militia, when I apply to them the terms used by the late Captain Home, R.E., when speaking of the French Reserves before the last Franco-Prussian War, that "they are a mass of trained, partly trained, and untrained soldiers," and I trust I may be excused in making the attempt to sketch out in what this state of things appears capable of improvement.

The first tendency in all cases where larger establishments or greater efficiency are demanded is to yield to the clamour for increased

expenditure, and the cry comes alike from Army, Navy, Militia, Yeomanry, and Volunteers that more money is required to render the Forces decently effective, although the Naval and Military Budgets already stand at an extraordinarily high figure, and those who are called on to finance for these Forces must be driven to their wits' end to avoid the calls for further expenditure, and to devise methods for economizing.

There must, however, be a limit to this, and in carefully considering the matter, with the knowledge, that to stint the Army or Navy of necessary supplies, or to check the growth of the Yeomanry or Volunteer movements for want of small reasonable grants, is short-sighted policy, our thoughts naturally turn to the Militia, the statutory Force of the country, with the feeling that if economy cannot be effected in this vote, no increase of expenditure need be required for it; but after a careful study of the Force as it has existed for the past ten years, and having fully considered the very numerous suggestions that have been put forward for its improvement, the conviction is forced on us that, palatable or unpalatable, this economy can only be maintained, and the Force at the same time raised to completeness and efficiency, if the law of the land, the Ballot, be enforced when requisite.

From what has already been advanced, I submit—

1st. That improvement is desirable in the numbers, composition, and efficiency of the military forces provided for home defence.

2nd. That for the Militia such laws should be enacted and put in force as will give the power of providing such a Force as would, along with the Yeomanry and Volunteers, be fully efficient and adequate for internal defence.

This I hope to be able to show may be done with little if any increased cost.

Before going any further, let us look back at what our ancestors did.

In the years 1803-4, or it may be said at a time when invasion of England was more seriously planned by a Foreign Power than at any period in the century, when Napoleon I was but waiting an opportunity to transport his fully organized and enthusiastic army from Boulogne to the coasts of England, confident of success if they could but land, George III, in continuation of former Militia Acts, issued one amending and annulling all others, and commencing as follows:—

“Whereas a *respectable* military force under the command of *Officers* *possessing landed property* within Great Britain is essential to the Constitution, and the Militia as by law established, through its *constant readiness on short notice for effectual service*, has been found of the utmost importance to the internal defence of this realm,” &c.

I would here invite attention to the words underlined by me—

1st. The force was to be “respectable” as regards the strength maintained.

2nd. Officers to “possess landed property.”

3rd. “Constant readiness on short notice for effectual service.”

To carry out the above conditions, the Act referred to further

provides, that out of a total population in England and Wales of some 8,000,000, a force of 41,000 Militia should be maintained, taken by ballot from all males, with a few exceptions, between the ages of 15 and 45, fit for service, and from every locality in proportion to population, endeavours being made to regulate the demand equally on all alike; that Officers appointed to the Militia should be possessed of property or estate in the county, city, or town, valued at that time at sums varying from 400*l.* a-year for a Colonel to 20*l.* a-year for an Ensign; that a man chosen by ballot might if he so wished, and was able, produce for his substitute a man of the same county, riding, or place, or of some adjoining parish or place, whether in the same county or riding or not, able and fit for service;

And, lastly, that the force should be kept efficient and in readiness for work at short notice.

Here, then, we have the State providing a sound groundwork of efficiency.

(a.) A simple and sure method of keeping the ranks fully supplied with the required complement of suitable men locally raised, with a minimum height of 5 feet 4 inches; each county being responsible for its own quota.

(b.) A complete establishment of Officers closely connected with the county.

(c.) The power of rendering all efficient.

With opportunities as described above, should the machine when put upon its trial have been found wanting or inefficient, all blame could with justice have been thrown on the Officers whose duty consists in keeping thoroughly serviceable the charge they receive over.

Such unfortunately is not now the case. Military or Militia Officers could not be held at fault for inefficiencies originated by such a system as the present, and the nation could blame no one but themselves. Instead of a Force as described above, provided by the Act George III, the military authorities have now—

(a.) A militia bearing a proportion to the population eligible for selection of about 2 per cent., with a very reduced standard of height and size; while the full numbers, owing to the scarcity of recruits, are never procurable.

(b.) An insufficient number of Officers raised from all parts of the kingdom, while the cadets use the force as a stepping-stone, and have, therefore, not its interests sufficiently at heart.

(c.) Insufficient power over the force to make them individually efficient.

Thus when the day of trouble comes, with its accompanying recriminations, blame could in no possible way be laid at the door of the military departments responsible for the Militia or of the Militia Officers themselves.

No better instance could be found of the apathy of the nation, of its tendency to leave existing conditions alone, and its dislike to face the possibilities of the future, than the late Socialistic riots in London.

The London Police were always looked on as a most efficient force, fully competent for all work likely to be required of them, but it does not come to light until a serious catastrophe has occurred, that the system under which they have for years past been working has been all along most faulty, and much of the blame is rightly attributed to this cause.

We can afford to run these risks in connection with riots and our Police Force, for we can rectify matters and pay compensation at our leisure, but with foreign invasion and our Militia it becomes, I may say, criminal, to rest until the nation can say, "We here hand over the materials and power for a complete organization," having thus done their duty, and being fully justified after that in laying all blame for any failure on those Officers to whose care they entrust the Force.

From the above, it will be seen that I do not propose to urge a desertion from our own institutions or imitation of those of a foreign nation, but to revert to so much of the Ballot Bills of 1803 and 1804, and to enforce so much of that of 1860, as will admit of the Militia being raised and maintained on an efficient footing, and the Force organized somewhat on the following basis:—

(a.) Strength of Militia Force to be fixed by the State at a percentage on the population; the local authorities of each county being responsible for their own quota.

(b.) Every male resident in the country between the ages of 18 and 40 years to be eligible to serve; except peers of the realm, clergy, officials of the Civil Government, Officers and men of the Army and Navy, efficient Yeomanry and Volunteers, employés in Government factories, and those physically unfit.

(c.) Terms of service.—Enlistment for ten years' Militia service, with liability to be called out after that to the age of 40 in case of invasion; all others between the ages of 18 to 28 to be available for ballot to fill vacancies in their own county.

(d.) The Force to be paid under regulations now existing; to be recruited as at present by voluntary enlistment, any deficiency in the quota being made up by the local authorities by ballot from the county.

(e.) A man chosen by ballot and unwilling to serve, to be allowed to find, if possible, a suitable and eligible substitute from his own or any other county.

(f.) Officers to be selected by the State from among applicants, residents of the county, in possession of landed or other property to the amount of, for a—

| | £ |
|------------------------------|-------------|
| Lieutenant-Colonel | 600 a-year. |
| Major | 400 „ |
| Captain | 300 „ |
| Lieutenant | 200 „ |

Failing a sufficiency of applicants, the required number to be balloted for among those in the county in possession of the above qualifications.

(g.) Officers to qualify by service with the local battalion of the Regular Forces until fully efficient, failing which to revert and complete service in the ranks.

(h.) The length of the annual training to be, if possible, reduced, and made good by an extra fifty-two hours per annum for preliminary drills and musketry.

(i.) Standard.—That a higher standard be fixed for artillery and infantry; men under height and over 5 ft. 2 in. to be enlisted for the other branches, such as engineers, transport, commissariat, &c.

(k.) Nothing in these regulations to affect the provisions of the Ballot Act, by which all males over 5 ft. 2 in., and between certain ages, are available for service in time of invasion.

Before considering the results to the country and to the Militia of these proposals, permit me to direct your attention for a little to the prominent factor in the scheme, “the Ballot.”

This word “Ballot” conveys to us a meaning with very much harsher accompaniments than in this case it really possesses, when we bear in mind that the ranks of the Militia are three parts filled at this moment by voluntary enlistment, that none of the inducements to this voluntary service would be abated, and that the ballot would only be enforced to complete the existing deficiencies in those counties which do not furnish their respective quota.

Further, when we consider the duties that a militiaman in peacetime is called upon to perform, duties by no means irksome, and which to many form a pleasant change, almost a holiday, we feel convinced that those who inquire into the probable results will find that the amount of enforced militia service which it would be necessary to exact would certainly not entail the hardship that at the first blush the word “Ballot” conveys.

Now to proceed with the different proposals:—

(a.) “Strength of the Militia Force to be fixed by the State, at a percentage on the population; the local authorities of each county being responsible for their own quota.”

As has already been shown, the drain caused on the male population resident in the United Kingdom, between the ages of 18 and 40, to furnish the 142,000 men now required, amounts to only about 2 per cent. This force, if kept up to full strength and highly efficient, is ample, but I submit the principles on which it is raised lack two essential qualifications—

Firstly.—The whole population do not bear the burden alike.

Secondly.—No sufficient provision is made for engineers, transport, commissariat, or any organization for harbour defence.

George III in his Ballot Act of 1803 drew Militia from every county, as far as we can gather, in proportion to population, and held each county responsible for its own quota; it being allowed to individuals to find a substitute from those not taken by ballot.

So it should now be; instead of recruiting the force from districts where men are most likely to be forthcoming, the old system of county organization as tending most to *esprit de corps* should be reverted to, the population of each county being drawn on to the

extent of 2 per cent., or whatever proportion may have been fixed, of males between 18 and 28 for its quota, to be raised as far as possible by voluntary enlistment as at present, and deficiencies to be completed by the ballot; arrangements for which to be carried out by the Lord Lieutenant of the county and entirely under the control of the civil authorities, who should cause lists of eligible men to be kept up.

Take as an example Devonshire; population of 286,242 males, from which the State now hopes for 1,742 Militia.

From this the number of Officers is complete, and there is a deficiency of about 500 rank and file; these the county would have to make good, being responsible for its own shortcomings. It does not at all follow that to do this the ballot need at once be enforced; the county would undoubtedly find various ways of producing the men required, and hold the ballot in hand as a last resort; while the State need not question the means, if legitimate, so long as the end be attained.

With regard to the second requirement, no Force of this description can be considered efficient that does not contain in itself a complete organization, and we should not rest satisfied with the provision of infantry and some artillery; the Force should consist of—

| | | |
|------------|--------------|-----------|
| Infantry. | Transport | } Corps ; |
| Artillery. | Commissariat | |
| Engineers. | Telegraph | |

the exact proportion of each being fixed by the military authorities, who would take into consideration the probable requirements of each county, while a full and sufficient body of men for torpedo corps and harbour defence boats, taken from the seafaring population round our coasts, could without difficulty be fixed; men below the standard in height being accepted for all except artillery and infantry.

(b.) "Every male resident in the country, between the ages of 18 and 40 to be eligible to serve, except peers of the realm, clergy, officers of the Civil Government, Officers and men of the Army and Navy, efficient Yeomanry and Volunteers, employés in Government factories, and those physically unfit."

The above are practically the classes who were exempted in years gone by.

Peers of the realm: by virtue of their position; some would add Members of Parliament; I would not, they can if they wish provide a substitute.

Clergy: out of respect for their occupation.

Officers of the Civil Government: because the Government of the country must proceed.

Employés in Government factories: because munitions of war will continue to be required.

Officers and men of Army and Navy: otherwise employed by Government.

Efficient Yeomanry and Volunteers: ditto.

And those physically unfit.

I cannot think of any other class whose duty it would not be, in the hour of invasion, to be up and doing.

(c.) "Terms of service.—Enlistment for ten years' Militia service, with the liability of being called out after that up to the age of 40 in case of invasion; all others between the ages of 18 and 28 to be available for ballot to fill vacancies in their own county."

The present system of six years' Militia service, with 25 per cent. passing into the Reserve for four years, gives us roughly 110,000 men effective, including Reserve, and after deducting absentees; this Reserve being unlike most others of the name, in that it forms part of the embodied force, and is no increase of strength, being simply a portion to be called out first, if required; while a compulsorily completed Militia with a service of ten years, and further liability for another twelve, would, if the establishment were maintained at 142,000, as it now on paper is, place more than double that number at the disposal of the State, in fact close on 300,000 men, a number in excess of what will, I think, be deemed necessary, and which would, after the first fifteen years, admit of a reduction of the embodied force to 100,000, yielding when complete 200,000 for defensive purposes.

Another alternative is worthy of consideration, viz., a recruits' training of 93 days and a shorter Militia service, say 4, 5, or 6 years, thus passing men quicker through the ranks and admitting of a reduction of the strength; but this could only be attempted after it was clearly proved that the required efficiency could be attained equally well with a shorter service.

As this scheme developed, and, as it undoubtedly would do, filled the ranks of the Yeomanry and Volunteers to overflowing, the possibility of gradually reducing the Militia could be taken advantage of.

Here again George III, at the beginning of the century, gives us a good line. From a population of 8,000,000, exemption from liability to ballot so filled the ranks of the Volunteers, that 300,000 were enrolled, and it was only necessary to keep up 41,000 Militia, a very different ratio to what now exists, viz., 250,000 Volunteers to 142,000 Militia, out of a very much larger population (17,000,000).

(d.) "The Force to be paid under regulations now existing; to be recruited as at present by voluntary enlistment, any deficiency in the quota being made up by the local authorities by ballot from the county."

The Militia are at present paid practically the same as the Regular Army, and with the Ballot in force it would undoubtedly be possible to effect a reduction of pay, and a saving on the vote. This, however, would rob the Force of much of its popularity, and render voluntary enlistment (which we have every right to expect should continue, as at present, the rule) the exception. If at the same time economy becomes imperative, reductions must take place in the pay of the Officers (exclusive of the Commanding Officer) and the rank and file, not among the permanent staff or non-commissioned officers.

Good Commanding Officers make good Officers and good battalions; without these it is hopeless to expect any efficiency, and no pains

should be spared to secure them. Raise the standard of indiscriminate selection to any necessary pitch, and offer what emoluments may be deemed advisable, but secure the best men possible for these posts, and much of the difficulty will be solved.

From Officers and non-commissioned officers of the permanent staff, as will be shown later on, much must be expected, and every effort and inducement should be exerted and held out to obtain thoroughly efficient men. No reduction in their pay would be good economy, and, as I said before, if compelled to offer them more, do so at the expense of the remainder of the Officers and of the rank and file. I think, however, it will be found that very considerable reductions can be effected, as I am proposing, without lowering rates of pay, which should only be resorted to for very urgent reasons, as tending, as a matter of course, to lessen the popularity of the Service.

(e.) "A man chosen by ballot and unwilling to serve, to be allowed to find, if possible, a suitable and eligible substitute."

This is a point with which the State need not concern itself; the man must appear or find a suitable substitute. We know well enough that Militia service, with its annual outing, change of scene and life, with its gaieties and fun, renders the duty sufficiently congenial to many, and that we need not fear that if men be driven to find substitutes, either as Officers or as privates, ruinously high sums will have to be given, or should they have to serve themselves, any great injury will have been inflicted on the individuals.

(f.) "Officers to be selected by the State from among applicants, being residents of the county, in possession of landed or other property to the amount of, for a

| | £ |
|------------------------------|-------------|
| Lieutenant-Colonel | 600 a-year. |
| Major | 400 " |
| Captain | 300 " |
| Lieutenant | 200 " |

Failing a sufficiency, the required number to be balloted for among those in the county possessing the above qualifications."

Next in importance to completing a military force with good recruits, stands officering it.

Sir Donald Stewart's remark that young soldiers can do anything if properly handled, contains the whole pith of the argument. Officers are nine-tenths of the battle; without efficiency among them there can be no real efficiency in the ranks.

Although the Army List shows a large number of Officers posted to the Militia, I think I am safe in saying the whole Force is close on 1,000 short of its full strength, chiefly in the junior ranks, while a large proportion of the subalterns at present use the Force as a stepping-stone to the Regular Army, and are therefore of but little permanent use to the Militia; further, although it is known how many really efficient Officers there are in the Force, we cannot close our eyes to the fact that there are numbers who look upon their duties in it as pastime and amusement, and scarcely the serious responsibility which

it in reality is, while there are Commanding Officers who not only are far from being at home in command of a single battalion in the field, but would themselves be more distressed than anyone else if asked to handle a brigade on parade or at manœuvres.

The importance of this question to the Force cannot be over-estimated; its whole value as a fighting machine, or as an expensive toy, hinges on it, and the Officers themselves are always the first who appreciate endeavours to practically improve their efficiency. To the value of drawing for Officers on the gentlemen of the county I attach the greatest importance, and further also the power, in the case of their not fully qualifying, of relegating them for their further service to the ranks of the Militia.

At present the book portion of examinations for Lieutenant, Captain, and Major is severe enough, were only the Officers as conversant with field duties. I do not for an instant mean to insinuate that there are not many who are so, but if there be a doubtful one, the power of replacing him by a certainty should be there. Half-trained soldiers are more difficult to lead than those fully trained, and much is therefore required from Militia Officers.

This proposition to expect the private gentleman, who in many cases has nothing to do but amuse himself, to apply some of his leisure-time seriously to Militia duties, will not be a popular one, but it is nevertheless one of the most essential points. Without local connection and a high standard of efficiency, Officers in a local Militia are valueless, and no sentimental ideas should for a moment be entertained to prevent the highest and best results being demanded from them.

The idea of the irksomeness of the duty is far greater than the reality, and once fully qualified, very little trouble is necessary to remain so, while to a young man who knows his work, interest is sure to arise in it, and pleasure and pride be derived from it.

(g.) "Officers to qualify by service with the local battalion of the Regular Forces until fully efficient, failing which to revert and complete service in the ranks."

The above runs with the preceding paragraph, and should be rigidly enforced; ample opportunities exist for Officers to thus fully qualify themselves, and no relaxation of the rule should be permitted, when we bear in mind that one inefficient Officer is a positive source of danger.

(h.) "The length of the annual training to be, if possible, reduced, and made good by an extra fifty-two hours per annum for preliminary drills and musketry."

The militiaman of to-day undergoes when a recruit a preliminary drill of fifty-six days in his first year, and an annual training of twenty-eight days. In his recruit drill the rough edge is taken off him, and he goes through a short course of musketry, while during the annual drills his time is fully occupied with setting up, squad, company, and battalion drills; three to four days are allowed for musketry, and one to brigade drills; the result of all this is, that, speaking generally of the Force, manœuvres in brigade are to them unknown,

and musketry stands at the lowest point. Officers and men who do not practise movements more than one day in a year, and that at most with only two or three battalions; who have never in their lives, perhaps, taken part in the manœuvres of large bodies of troops, cannot possibly be expected to know anything about it, and would have to learn their lesson as best they could, if time were allowed them, after war broke out; while as regards shooting, nothing could be done but accept matters as they stood.

An Inspecting Officer says of the Militia, "making every allowance, the shooting is very, very far from what it should be, and every effort must be made to reach a higher standard," while an Officer of the Force remarks, "they are to a great extent untrained in shooting." This is scarcely to be wondered at, when we know how little time can be spared for musketry; that the permanent staff have, in that short period, to deal with 600 or 800 men, to whom it is impossible they can do justice in the time, resulting in many corps putting only a half battalion through each training; that out of 148 battalions, only about 100 train annually; that only about 70 per cent. of those embodied can be got for musketry; and that barely 50,000 of the whole Force annually go to the targets, the natural result of which is, the figure of merit of shooting is very low.

Now, considering that the beginning and end of soldiers is, that they shall march and shoot, that they shall be capable of being moved in masses from point to point, and, when required, handle their rifles skilfully and accurately, reflection as to how far our Militia of to-day, in its training, prepares itself for or comes up to these requirements, must cause serious misgivings. To effect improvement in the manœuvring power of the force would be a simple matter, calling for a little increased attention to that branch of training, but good shooting cannot be taught in a hurry; it must be the result of patient care, training, and practice, without attention to which all soldiers are valueless. Officers labour at and elaborate schemes for the defence of the country, but what, I would ask you, is the use of schemes of land defence of any sort, if the men we purpose using in these defences can't shoot? Until we ensure good shooting, schemes of defence, be they ever so able, are only worth the paper they are written on. General Brackenbury accurately described what we require, when he said:

"If we could only train infantry soldiers to shoot until each man had such confidence in himself and his weapon that he felt himself equal to any odds, you might do what you pleased with them;" and towards this end we must always strive.

To arrive at this in the Militia, a change in the system of training will be necessary; shooting and manœuvring must be the crucial test of efficiency, not smart appearance, marching past, and battalion drill.

Considering the number of men to be dealt with in each corps and the size of the permanent staff, it will be necessary to have the power of carrying on instruction for some additional time other than the annual training, when all are fully occupied, with a view to working the men up in preliminary drills before they are embodied, and

thoroughly preparing them in musketry : to this end I have proposed that one hour per week, or a total of fifty-two in the year, be devoted to this purpose.

This amount of time is little enough to expect from a man for such an object, and it could most profitably be spent under the superintendence of the permanent staff, on the drill ground or ranges, in the long summer evenings or on half holidays, and in shooting galleries during the winter nights.

We hear reports of Militia battalions being unable to practise for want of ranges which one can scarcely believe to be true ; the State might as well disband corps, whom it is not prepared to instruct in musketry, and should allow no expenditure to take precedence of ranges and shooting galleries for its troops of all classes. That the shooting of Militia Artillery is below the mark cannot be wondered at, if their want of opportunity be realized or known, and this can best be described in the words of an Officer of that branch when speaking of his own battery, viz., " They have never seen, fired from, or drilled with a rifled gun of any kind, or ever seen a rifled gun cartridge, and they only use their carbines for manual and platoon drill." To carry out this intermediate instruction, which should for the convenience of the Force be spread throughout the year, the permanent staff of the Militia would require to be placed more fully at the disposal of the Commanding Officers of Militia battalions than they at present are.

It is of course necessary that the Militia should bear its share, but not an undue proportion, of the duties arising from the brigade dépôt, the benefits of which it enjoys with its affiliated battalions of the Line, but no duty should be allowed to prevent their permanent staff from giving full and undivided attention to these intermediate drills.

If these 52 hours be effectively carried out, in no way interfering with the present preliminary drill of the recruit, which is in all cases necessary, the militiaman will present himself before his Commanding Officer a decently drilled man, sufficiently instructed in target shooting, and it will only remain needful to drill him in battalion and brigade, and exercise him in manœuvres with field-firing, and should men be found still inefficient, power should be given to Commanding Officers to render them efficient by keeping them for a further fortnight or month after the completion of the annual training for musketry instruction, until they reach the required standard.

Under such conditions we are, I consider, justified in considering whether the period of annual training could not be reduced, and I submit this could be done to the extent of 14 days, without in any way diminishing the efficiency of the Force, at a saving of expense to the State, and at the same time withdrawing men from their occupations 14 instead of 28 days. With men prepared as I have proposed, by their 52 hours in musketry and elementary drill, the fortnight of annual training would amply suffice for—

1st Week.—Muster,
Issue of Clothing, &c.,
Battalion and Brigade Drills,

2nd Week.—Manœuvres or Camp of Exercise,
Field Firing;

which, with a sufficient permanent staff and thoroughly efficient Officers who must beforehand have learnt their work when attached to the Regular Army, would I feel confident yield very much higher results than are in any degree possible under the present system.

Some will doubtless urge the difficulties that may arise in carrying out the fifty-two hours' preliminary drill; I can see no more difficulties than at present oppose the Volunteers; they find it possible to devote stray hours throughout the week to drill, and there is no doubt that there are numerous idle moments which could be profitably so employed; these the permanent staff must watch and utilize to the best purpose, while it would seem advantageous and economical that these setting up and musketry drills should be given along with those of the Volunteers whose sergeant-instructors might materially assist the permanent staff of the Militia, and *vice versâ*.

Others will argue, that as much is lost by dispensing with 14 days of the annual training as by adding 52 hours of preliminary drill; this would, however, not be the case. Granting that every recruit receives his 56 days' recruit drill, 52 hours per annum will be ample for an intelligent, willing man, who picks up some small idea of musketry, to qualify, while those less skilled with the rifle could devote more preliminary hours to practice, well knowing that any shortcomings on their part would render them, in common with all who are found inefficient from carelessness or other causes, liable to a fortnight, a month, or such additional drill after the completion of the annual training as the Commanding Officer might deem to be requisite.

To this power in hands of Commanding Officers, to detain Officers and men till qualified, the highest importance may, I feel sure, be attached. Voluntary effort, as a question of self-interest, in addition to zeal, will with the majority be encouraged to the fullest extent, while at the completion of the training the whole attention of the Staff could be devoted to those who have been found backward.¹

While on this subject it appears clear that the two points in the training of the Militia soldier, which should never be lost sight of, irrespective of the branch of the corps to which he may belong, are—

(a.) That he shall be led to take an interest in shooting and be thoroughly instructed in the same.

(b.) That he shall spend one week of the annual training in a camp

¹ Since writing the above, a Militia Commanding Officer has kindly given me the opportunity of inquiring from his men, in his presence, as to how the proposed change would affect them. With one exception all preferred the 14 days, being confident that they could find the time to do the 52 hours in their leisure moments, and also that they could thus reach a higher average in musketry.—A. D. A.

of exercise, if it be only a small one, and that opportunities as convenient be taken of moving and forming bodies of Militia on different points with defensive objects; all duties being performed by the force with its own men and material and without aid from the Regular Army, and further, that when sufficiently far advanced, Yeomanry and Volunteers be brigaded with and formed on them.

(i.) "Standard.—That a higher standard be fixed for infantry and artillery; men under height and over 5 feet 2 inches to be enlisted in the other branches."

Although the localization of the Army and the connection of Regulars, Militia, and Volunteers was perhaps one of the soundest and most beneficial measures ever introduced, the continuation of which, the still closer binding together of the three forces, should never be lost sight of, as tending to materially improve all; one point that should not be encouraged is, that by means of this connection, small, under-sized men may make use of the low standard of the Militia (5 feet 3 inches with a 32-inch chest and less for boys) to obtain an entrance into the Regular Army, thus lowering its standard of size.

George III accepted no one under 5 feet 4 inches in his Ballot Act; we have not only fallen below that for our voluntary Militia, but down to 5 feet 2 inches in our Ballot Bill of 1860.

Note what the Inspector-General of Recruiting says: "If it is agreed that a man between 5 feet 3 inches and 5 feet 4 inches when properly developed, and with a good chest, can make a good infantry soldier, then the criticism as to shortness *quâ* shortness falls to the ground."

But this is not by any means agreed to; the military authorities are, against their will and wishes, driven to low standards to keep the ranks in any way up to the establishments.

What does raising or lowering the standards denote? Not a change of opinion as to the class of men, but a plenty or a scarcity of recruits; we find the ranks of the Foot Guards filled over establishments, the standard is raised from 5 feet 7 inches to 5 feet 8 inches; recruits are scarce for other portions of the Army, the standard is lowered in one way or another. On no point is there a greater consensus of opinion among Officers of the Army and Militia than that, though the recruit of to-day and of the last few years has steadily and decidedly improved in education, intelligence, and orderly behaviour, as compared with his predecessors, the physique, height, and chest measurement have fallen off and are below what is required.

This opinion is also found fully borne out in the reports of Officers commanding regimental districts where recruiting is carried on. There is no necessity to discuss this fact or its causes: there it stands firmly rooted in the minds of nine out of every ten Officers of every branch of the Army, and the nation should not and cannot afford to ignore it.

The short service system, with its necessary reserves, forms a younger army than did long service, while youth combined with reduction in physique entails a loss of power which becomes a serious

consideration, and can only be met by raising the standard of both Regulars and Militia.

This should be done to the extent of an inch, and no man be taken under 5 feet 5 inches into the Army, or 5 feet 4 inches into the Militia, for infantry or artillery, with proportionate chest measurement.

In the case of the Army, it is yearly becoming better known and more popular; but even should raising the standard mean extra expenditure, it is an outlay that should not be shirked, while in the Militia it would only necessitate a greater number being completed by ballot, and would ensure a larger stamp of man and one more suited, in the opinion of all, for the work required of him.

A certain proportion of the smaller men from 5 feet 2 inches to 5 feet 4 inches, and in the Army 5 feet 5 inches, but with good chest measurements, could with advantage be utilized in all the branches of the Army and Militia except those already mentioned.

(k.) "Nothing in these proposals to affect the provisions of the Ballot Act, by which all males over 5 feet 2 inches between certain ages are available for service in time of invasion."

Whatever regulations the State may adopt for the Militia, Yeomanry, and Volunteers, the power of calling on every efficient male for service in case of invasion would as a matter of course be necessary, and all the machinery for exercising the ballot for this should be kept in readiness.

Having now sketched out, as fully as space will permit, proposals which, in conjunction with the introduction of the ballot to fill vacancies in the Militia, would, I submit, materially strengthen and improve the Force, let us turn to the probable effect of the same on the Regular Army, the Yeomanry, and the Volunteers.

History continues to repeat itself, in recording the valuable assistance afforded to the nation and the Regular Army by the Militia in the Peninsular and Crimean wars; whole battalions volunteered for active service, while regiments were transferred twice over to recruit the troops in the field, and first-class work many of them did; but that was in the times when wars started slowly and progressed equally slowly; the Militia of the day had then plenty of leisure to organize and perfect itself.

Now, when everything moves faster, when large armies are kept ready for immediate action, and wars are commenced, carried through, and ended with the greatest possible rapidity, it is madness for us to leave any essential precaution to the chance of being allowed time to attend to it when war is declared; and what is deemed requisite for the Militia should before everything else receive attention and preparation, to ensure that if required for service in or out of the kingdom, we may safely rely on them.

Since the introduction of the localization scheme, the ties between the local battalions of the Regular Army and the Militia have gradually tightened, as may be seen by the steady increase of recruiting from the latter to the former, amounting in 1884 to 13,259 men from the Militia out of 35,653 recruits raised for the Army. Thus,

not only is it of importance to the Army that these men be of the best possible stamp, and well drilled, but it is of far greater moment that the Reserves (as Militia battalions undoubtedly are) which they leave behind them when they go on service, and to whom they naturally look for their best recruits, are thoroughly efficient and on a sound footing. Still further, the knowledge that we possessed a highly efficient Militia would immensely strengthen the hands of the military authorities when denuding the country of the Regular Army to support our forces in the field, in that the legitimate defenders of the nation were at hand and equal to their own task.

That the Yeomanry would find it easier to complete their numbers, were freedom from Militia service granted to them, most of their own Officers will readily allow, and though we have no former experience on this point to work upon, I feel certain it would be found to be so. Should it, however, turn out otherwise, theirs is only a question of horses; given a sufficiency of these to hand, the Yeomen will be forthcoming, and it would, after trial of exemption from Militia Ballot had been found ineffective, become necessary to consider whether it might not be better to reduce the present number, 14,405, of whom some 4,000 are now deficient, and slightly increase the capitation grant.

The benefits that would accrue to the Volunteer Force by exemption from liability to ballot for the Militia being granted to efficient Volunteers are admitted by all, and can scarcely be calculated.

Friends of the Force, in their enthusiasm, claim for them great things, such as "being our first line of defence in case of invasion," &c., &c., while they make many suggestions, chiefly in the shape of appeals to patriotism, by way of remedy for existing inefficiencies, but there it may be said the matter rests. The Force is, I understand, at this moment some 1,500 Officers and 50,000 men short of what is considered full strength, while none will deny that with opportunities, many of the inefficiencies complained of could be removed. The world produces no finer force in physique or intelligence than our Volunteers; and as a nation we have every reason to be proud of them, but their organization precludes our getting at them with a view to increasing efficiency in any other way than, as it were, indirectly.

The exemption of efficient Volunteers from Militia service would, however, effect what nothing else will, without in any way touching the constitution of the Force as purely voluntary. As only a thoroughly efficient Volunteer would be exempted from the Militia ballot, the Officers would be able to insist on greater regularity and attention to drill than they can now do, and also to introduce and enforce a sufficient code of discipline; and thus the whole condition of the Volunteer Force would be most materially improved. It is probable that the indirect pressure of the ballot would be so great, that applicants for service as Volunteers would exceed the requirements.

George III, in 1803, similarly exempted Volunteers, with the result that 300,000 out of the then much smaller population were enrolled. We do not require that number at present, but the State could by

this means raise the standard of efficiency of both Officers and men in shooting and general duties to any reasonable pitch. A claim for an increase in the capitation grant has just been staved off; but it is necessary; the State will have to give in, and the pockets of the Force will thereby be relieved. I would suggest that, in making the grant, a part of it be applied to providing drill halls and musketry ranges, which would do for the training of the Militia as well as the Volunteers. The Volunteers are not, and cannot ever become, our "first line of defence," but they are a most valuable and necessary adjunct to it, their efficiency ranking only second in importance for internal defence to that of the Militia; and in the manner I have pointed out this may be very materially improved without any additional expense.

Let us now enumerate the advantages that may with justice be claimed for these proposals:—

1. A thoroughly efficient Militia for our first line of internal defence, upon which economy can be effected by—

(a.) Reduction by degrees of the force from 142,000 to 100,000, or even lower, if the Volunteer force were increased.

(b.) Shortening of the annual training.

(c.) Saving of all expenditure on the present Militia Reserve in the shape of bounty, &c.

2. A strong and efficient reserve for the Regular Army.

3. The completion of the Yeomanry and Volunteer Forces to full established proportions, at the same time materially raising the standard of efficiency.

The one drawback that can be urged to this scheme is the unpopularity of the ballot.

Officers and civilians of all classes who interest themselves in these subjects bring to notice, lament over, and suggest, partial, and, as a rule, ineffectual remedies for the numerous shortcomings of the Militia, Yeomanry, and Volunteers, all alike admitting that the only panacea for all and everything is resort to the ballot; while, if my information be correct, I understand that Lord Cardwell went so far as to include provisions for the ballot, which he afterwards struck out, in his Militia Bill of 1871; but all shrink from introducing it; not because it will cost money, not because it will in any possible way fall short in effecting the desired results, but because it may or will be unpopular, because they consider the nation is not prepared for it. Under these circumstances we are justified in asking, "When will the nation be prepared for the ballot?" The answer is simple enough; not until invasion is at the door, until foreign troops are embarking for a descent upon our coasts; a line of action the madness of which should be unceasingly brought to prominent notice by every individual in any way concerned with the safety of the country.

It cannot be too clearly understood that the nation is placing its reliance on forces which are not, and never can be (owing to their organization), in a forward condition of preparedness.

Since the beginning of the century gigantic strides in readiness for war have been achieved by the armies of the larger European States

and by our own, but while foreign Powers carry these reforms throughout their whole forces, we stop short of our Militia, Yeomanry, and Volunteers. These with us, it may be said, stand, with the exception of a change in weapon, where they stood at the commencement of the century, the Militia, owing to relaxation of the ballot rules, may even be considered to have gone back in its completeness and efficiency for immediate service, and nothing that Military or Militia Officers can do will be of any avail to raise their condition much above what it now is and has for years past been, unless the organization be altered.

This ballot, too, which it is proposed to introduce, will, as I said before, on inquiry, be found to be far less irksome than is imagined.

The Militia force is at present kept up to three-quarters of its establishment in Officers and men by the present inducements, none of which would be abated or reduced, voluntary enlistment continuing as before, while more work in the non-training season and a shorter annual training would be expected from the rank and file; recourse only being had to the ballot in the case of deficiencies, and that, in the county, to complete its own quota.

Voluntary enlistment and a partial ballot would be able to, and would, I feel confident, work successfully and harmoniously side by side; the community would suffer in an infinitesimal degree, if at all, and the nation would be a material gainer.

Colonel the Earl of WEMYSS, A.D.C.: I think we are greatly indebted to Major Anderson for having brought this vital subject before the Royal United Service Institution. I regret that it has been done in Ascot week, because the attractions of the racecourse I have no doubt have thinned these benches, and I think it is worth the consideration of those who have charge of this Institution as to whether another year it would not be better not to have so important a paper as this read in the middle of Ascot week. I do not think that one can very well exaggerate the importance of this question. Major Anderson in his paper has touched upon many points which I shall avoid, questions of detail as to height, chest-measurement, shooting, and various other things which are wholly independent of the question of the ballot. With reference to that question, which is the important consideration before us, there is much with which I agree in what Major Anderson has said. For instance, the state of our military organization, whether you look to the supply of men in the Army or the Militia, or to the comparative inefficiency of the Volunteers, is thoroughly unsatisfactory. When Lord Cardwell introduced his Reform Bill in 1871, I recollect making a very strong speech against it in the House of Commons, and I venture to say this new system, which was to remove from us for ever anything of the fear of invasion, was simply being founded upon quaking bog and shifting quicksand in the absence of the ballot. And so it has proved. We were promised a reserve of 80,000 men by the year 1880, but we have nothing of the kind. I do not believe you have more than 40,000 men in the Army reserve at the present time. As Major Anderson has pointed out, the Militia is our backbone, but as I have often expressed it, it is in an invertebrate condition, being always 30,000 short, while the boys you see running about in red coats are not those to whom anybody would like to entrust the defence of our hearths and homes. General Peel when he established the Militia reserve intended, not that they should be taken out of the Militia, but that for every man who volunteered from the Militia to the Militia reserve the Officer in command should be empowered to raise another. So much for the importance of the ballot as regards those effects. I believe the ballot is really the only remedy for the present military organization, and till you have that as the

foundation of your military system, it is a matter founded upon sand and will never be satisfactory. Major Anderson has spoken of the way in which he would apply the ballot, and there I venture to differ with him. I thoroughly agree as to its necessity, but I think it might be applied, and I know that is the view taken by General Erskine, in a very much less onerous way than is proposed by Major Anderson. When Lord Cardwell put the ballot in the Bill to which I referred, which he subsequently struck out because of the difficulty in passing the abolition of purchase for the Officers, those who fought it in the House of Commons did not do so on account of the Officers, but simply because we believed it was the wrong end of the stick, and because it was the ballot that they ought to have laid stress on and not the abolition of purchase. We know that purchase Officers could have been trained up to any degree of efficiency, and therefore it was really throwing dust in the eyes of the British public to try and make them believe that the abolition of purchase could increase the efficiency of the Army, the really important thing was the ballot, but it was not to enforce the ballot. The object of Lord Cardwell's Bill was to simplify the machinery of the ballot, the ballot had not been in force for years; it was to simplify the machinery, that was all, and even with the simplified machinery it was calculated that it would take at least three or four months before you could get a single man. That was the reason why we opposed Lord Cardwell's Army Bill. Now can the ballot be applied less harshly than is proposed by Major Anderson? I venture to think it can. I object to the ages which he proposes, I object to the time of service, I object to substitutes, I object to qualifications, and there is one exemption which I object to very strongly, that is the exemption of "peers of the realm." I think they would be glad to take their share, and as one, I repudiate the exemption as far as I myself am concerned, though I am sorry to say I am past even the ballot age as fixed by Major Anderson. Major Anderson proposes that every boy from eighteen up to forty should be liable to be struck for the Militia. I have often spoken on this Militia question; I brought it two or three times before the House of Commons, and before the House of Lords I have spoken of it many times. In doing so all I have ever asked for the ballot has been this, that at the age of twenty every Englishman should be liable to serve his country in some shape or other. My exemptions would be exemptions of service and service only, except professional men such as clergymen and Government Officers who are also serving in another form, that unless a man when he attains the age of twenty can show that he is serving already in the Army, Volunteers or Yeomanry, and that he has engaged to serve 3, 4 or 5 years with those forces, he shall then be liable to be struck once in his life for the ballot for the Militia. That is all; there should be no substitutes, the only substitution would be another kind of service. I think there is a strong feeling that money exemption would not be desirable, and that if you have men who are liable to serve that they should serve in person in some form or other. General Erskine had a very good suggestion when he was at the War Office, a very simple way of applying the ballot. I believe at present under the Militia Law, beside the force annually voted of 140,000 men, there is power also to raise 60,000 more, and General Erskine's proposal was that these 60,000 men should be raised by ballot gradually, in five or six years, 10,000 a year, but that they should be simply there and not called out, that you would have them in hand. In that way the people would get gradually accustomed to it, and it would be no hardship upon anybody; they should be liable during the term of their five years to be called out for training if necessary. In that way you would have 60,000 men ready to put your hands on without having to wait months and months to get them and then begin to train. That seems to me to be a very practical and simple way of dealing with this question. As regards the effect of the ballot upon the Volunteer service there is no question about it; you could then do anything you liked with the Volunteers, if they did not fulfil the full conditions required of them, if they were not engaged to serve three or five years. Any man who failed, even though he had passed the age of twenty, to fulfil all the conditions of efficiency in any one year ought to be balloted for the next year, and with such a screw as that on both the Yeomanry and Volunteers there is nothing in the world you could not make of that force, which comprises upon the whole a superior class of men to those found in the Militia. I have nothing further to trouble you with except to say this,

that I hold the first duty of citizenship to be to defend your country. That is your birthright, and with all the blessings of our island home the first duty of an Englishman is to defend his country. We hear a great deal about the German and another Continental military systems; I think the old English military system of last century is absolutely and entirely sound if properly applied. You may talk about "conscription." The ballot is not universal conscription. You could not go for universal conscription, to take men from their homes in this country and send them out to India and Timbuctoo. Englishmen are very fortunate as compared with other nations that so little is required of them in the way of compulsory service, but that they should be compelled to serve in some form or other is only right. Do not forget this, the ballot really is a great privilege and a boon, for instead of every man, which is the theory of the English military system, being bound to serve when called upon, it gives the population a chance of escape and the lot only falls upon a few. Therefore the ballot instead of being a hardship is really a boon, and I maintain as applied in the more moderate way that I venture to suggest instead of the more stringent way proposed by Major Anderson it would not be unpopular. No man who has had anything to do with public life, who knows anything of Army or Navy matters, can fail to know this, no man who has ever held the position of a Commander-in-chief will not tell you in private that the foundation of the Army and our Militia rests on the ballot. No Secretary of State would refuse to tell you the same thing only they are afraid of Parliament. A Conservative Secretary of State who brings in the ballot is afraid lest there should be the cry of "coercion" in another form, and that the other side will go to the country denouncing this horrible military coercion. It would be just the same on the other side, if the Liberals were to do it I am afraid the others would, and I know with regard to Lord Cardwell, this is an historical fact: that when he was considering what the great military reform of 1871 was to be that was to make this nation for ever safe and free from panic, that although we put in the Bill only the machinery of the ballot, the idea was also to strengthen our new military system by establishing the ballot. I was going to give a notice in the House of Commons upon the subject, and Lord Sandhurst, then commanding in Ireland, had been called over from Ireland to consult with Lord Cardwell upon the whole military question, and he said to me, "Don't be in a hurry about this, for my hope and belief is that they are really going to establish the ballot." I only wish they had: that is all I have to say.

Major McDONNELL (late 19th Middlesex Rifle Volunteers): After the able speech from Lord Wemyss, I need not make any remarks on the general questions raised by Major Anderson, but there are one or two points of detail on which I should like to say a few words. In the first place, as to the provision which Major Anderson has made, not without much precedent, for substitutes. I hope this system will never be again recognized in this country. The privilege of getting a man to serve for you by a money payment appears to me to be thoroughly bad, and to have been shown to be bad in other armies. The French Army would have been better in 1870 if the system of substitution by money payment had not existed, and certainly the opposite system has helped the Germans in bringing their Army to its present marvellous state of efficiency. By the fact that substituted service is absolutely and sternly forbidden they do sweep all classes into the military net; the whole nation is fairly represented in the armed forces, and that enables them to make their military machine more perfect than they otherwise would have been able to do. The value of this prohibition of substitutes is practically recognized by all the great military nations of the Continent. No substitution is allowed now in France, Germany, or Austria, I do not know about Spain or Russia, but I believe not in Russia. I quite admit that there must be some safety valve, that is, some consideration for the value of the time of the more highly educated young men. The Germans as we know have the safety valve of the one-year volunteer system, which is very ingenious and works extremely well. If the ballot were revived in England and substitution absolutely forbidden in England, the effect would be this, that our safety valve would be that the young men who in Germany enter the Army as one-year volunteers, would in our country qualify themselves either as Officers for the different

branches of the auxiliary forces, in which case we might get great efficiency out of them, or they would at the worst go into the ranks of the Volunteers, and by that means you might very greatly raise the standard of efficiency of the force. But if you do allow a man who is drawn for the Militia to buy a substitute, every man who by hook or by crook can scrape sufficient money together will pay a substitute. This is particularly found to be the case in Belgium, where substitutes are still permitted. I heard of a case there the other day in which a friend of mine, a professional man, a doctor, had paid a very considerable sum of money, I think 200*l.*, for his son, a student for the bar, rather than permit him to go through service in the ranks. If it were allowed here you would find the very same thing would occur, the middle classes at any rate would stand aloof—as many of them I am sorry to say do at present stand aloof—even from the ranks of the Volunteers. But if you did not allow that money payment of 50*l.* or 100*l.*, then you could make really efficient fencibles or militiamen or whatever you pleased of them; and you could raise the standard of the education of your Officers in a way that you never will be able to do till you have some form of compulsion. I hope if the country has the courage to adopt compulsory service, it will also have the courage to say that neither peers of the realm nor any other persons shall be competent by money payment to escape the balloting and actual personal service. To go to another point. In the first part of the lecture Major Anderson drew a comparison between the condition of France at the latter part of the war of 1870–76, and England after an invader had gained a foothold here. He said: “We need, for an illustration of the fate of such unpreparedness, go no farther than the campaign of 1870–71, where we saw the fairest provinces of France devastated by war, nobles and peasants alike sacrificing their lives as simple volunteers in the ranks, in a fruitless endeavour to retrieve what want of organization and preparation on the part of the State had entailed on their beloved country. Such would be the case with England if invaded by hostile foes; thousands of all classes would gladly and proudly volunteer their services, but they would be but a courageous armed mob, with whom it would be practically impossible to achieve anything, owing to want of previous training, and they would be annihilated by regular troops, as were the Garde Mobile of France by the organized forces of the German Empire; while money would be made to flow like water, to, if possible, remedy what would then probably be irremediable.” I do not think these are quite parallel cases, because the French had only untrained levies at that time, and their territorial organization for those levies was interrupted by the outbreak of the war. But our untrained levies would at any rate have the Volunteer organization to receive them as it were, and mould them into shape, every man would have some *cadre* to fall into. I believe, therefore, that our last line of defence would be a better fighting machine, though not a more gallant one, than the French levies of 1870.

Lieut.-Colonel GARNHAM (late 3rd Battalion West Riding Regiment): As a witness before the Committee of 1876, I wish to say a few words. I remember being asked the question as to what I thought of this question of balloting for the militia, and my answer was I thought it was one which concerned the statesman more than the soldier, because the soldier could only have one opinion on the subject, which was that it was the most important thing for the military organization of the country. I therefore am pleased to find that this subject has been so ably brought forward by Major Anderson, who is not a Militia Officer, but an Officer serving in the active army. I am delighted as an ex-Militia Officer to find that such interest exists in a lively way amongst Officers who are serving. There can be no doubt of the importance of the ballot to the Militia, and through the Militia, as Lord Wemyss has said, to the Volunteers. With respect to the Militia, it would be invaluable because it would in the first instance remove any difficulties on the part of employers of labour. I have had men come to me in my regiment who gave up 30*s.* a week for the pleasure of serving for their month in the Militia. They had to go back again to a very much lower rate of wages, their places were not kept open for them, and they did it for the pleasure of serving. See how it would help those men if the master himself knew that it was a good thing for him to have a certain number of his hands in the Militia. I happen to have served in a Yorkshire regiment where we depended a great deal upon mill

hands—see how it would assist in protecting the master of a mill from the chance of being drawn for the Militia, if a number of his men voluntarily served in it. And I think one of the best parts of the scheme propounded by Major Anderson is that the present voluntary system should go on. I quite agree with Lord Wemyss in thinking that the ballot might be so worked as to be in no way oppressive to the working population of this country, but there is this difficulty in all questions relating to the Militia, namely, the very different circumstances under which Militia regiments are raised and serve. I remember General Herbert in a letter which he wrote to me upon Militia matters saying that, and of course in some districts it would be very much more difficult than in others, and the ballot would press upon a different class of men. In the manufacturing districts it is a question of trade whether you get the men; if trade is brisk you have to go into the market to tempt them. In the agricultural districts it might press more severely upon persons in better positions of life, but I am convinced myself it only requires to have a statesman who is bold enough to bring the ballot forward and the thing would be done. In the meantime it is most useful that it should be brought forward here, and I quite agree with what Lord Wemyss has said. The only comment I can in any way make on the subject of the lecture is, that I think the details may to a certain extent obscure what is the really important question to keep before the public, that is, the great question of the necessity for the ballot in the Militia. We cannot settle those details now. If we were discussing those details I could make many remarks, but I quite agree that it is only necessary to look at the principle, which is, that the Militia requires help. What the need for that help is only those Militia Officers who have served in every rank, as I have done, can know, they alone can know what it is to come into this Institution as I have come time after time to hear excellent suggestions made by Officers of experience, and to know that when they walked out of the doors, they were obliged to shut off any hope of those suggestions being carried out owing to the question of money. I remember an ex-Financial Secretary of the War Office, Colonel Loyd-Lindsay, presiding here; a good many Officers had made some very valuable suggestions, I had made one very humble one, and he said, "The only suggestion that there is any chance of being carried out is the one made by Colonel Garnham," not because it was the best, but simply because it happened to be the one which did not require any money. Now this is one which does not require money. It is certain that a system of conscription in an industrial country like England would be fatal. Much as the soldier must admire the system in Germany, there is no doubt it is sapping the very vitals of that country, the way in which every man has to devote a considerable portion of his time and service to his country is and must be detrimental, that is a known fact, independent of our Colonial service, which would make conscription an impossibility. But I fail to see a difficulty in really raising the few thousands more that we want to complete our Militia. It is not only raising the numbers, it is strengthening the hands of the authorities, and what we want to do with respect to the Militia is to raise its tone, to make it as military as possible, and to get rid as far as possible of that cursed question—excuse the strong word because it really is a real curse to the Militia—the question of money. You want a range, you cannot get it because it costs money; you want men, you cannot get them because wages are higher. We have money before us as a difficulty in everything. The ballot would level a great many of these difficulties. I do not agree with the lecturer in thinking that the expense of the Militia would be reduced, because I do not think less training or less anything in the way of cost would result from it; but the force, the power which you would exercise would make your service three times as efficient. You would have a greater hold upon your men, you would get men of a better class, you would in every way have a greater pick; but as to reducing expenses there I must differ, because the only way in which the Militia service can be efficient is by increasing the facilities for improving it, notably in that most important question of musketry. Musketry is the first thing to be considered, and unless we have ranges and money at the disposal of the Militia it would be perfectly useless bringing together more men. But by bringing in men with aid of the ballot we should then not be obliged to take the lower class of men who, on some occasions, we are obliged to take now, and we should raise not only

the tone of the Militia but also of the Volunteers, because there are a great many men in the Volunteers now who do not belong to the artizan class. We ought to have these men in the Militia instead of a still lower class, and the more you raise the Volunteers by getting into their ranks the artizans, the more you will in that way send the next lower class of men into the ranks of the Militia. I had for many years the privilege of being on friendly and intimate terms with the Inspecting Officers of Militia, and I was the first to call the attention of the authorities to the fact that men were serving at the same time in the Militia and Volunteers. In my company when I was a Captain, I had twenty-five Volunteers serving who were in the Volunteers at the same time, and it was owing to that representation on my part, that regulations were issued which rendered it almost impossible for them to serve in the two. We are all very much obliged to the lecturer for having brought this subject forward. Matters of detail will have to be left, but what we want is to put support in the House of Commons with reference to this question of the ballot.

Colonel EVELYN, 3rd Battalion East Surrey Regiment: It is very satisfactory to hear a paper so interesting and containing so many important matters respecting the Militia introduced by an Officer of the regular service. I think that the views not only expressed in the lecture but also those which fell from Lord Wemyss, are those which I myself and many others have constantly urged in this theatre, that our military system is good in this country if it were properly carried out, and that instead of introducing the systems of Germany and foreign countries, we ought to try to develop our own system, as it is capable of development. The Militia is the most important of all branches, it is the ground of the whole because it is the only branch of the Service to which the ballot could possibly be applied. A pamphlet which has had a great circulation, and which I believe comes from very high authority, would seem to advise the ballot for the regular Army, but we could not possibly apply that to engaging men to go all over the world. For that reason it is only the Militia to which the ballot in any form could possibly be applied. The three branches of the Service are distinct: we have the Army, which ought to be highly paid, liable to general service; the Militia, which need not be so highly paid, only for home service; and the Volunteers, who theoretically should be men who are able to pay for their own military training. That I think is a point that has been very much forgotten of late, and unfortunately so. I do not like these constant increases in the sum allowed for each Volunteer; I think it will interfere very much with the service of the Militia; and I know that the Volunteers are composed of quite a different class of men to those of which they were composed during the first few years of their establishment, when I took great interest in the Volunteers and worked very hard to get them up. I was looking at a Volunteer regiment the other day. I inspected every man in the regiment carefully, and from the look of them I could see they were of the labouring class, in fact men who served for the sake of the suit of clothes that they got. Instead of that they ought to have to pay for their own clothes, or be liable to be drawn for the Militia. I do not think that unless we keep constantly in view these three points, the Army, Militia, and Volunteers, the one highly paid, the other less paid, and the other unpaid, that the system of the ballot could be applied to the Militia, for if the terms of the volunteer service are made such that labouring men can afford to join, and thereby escape the ballot, few will enrol voluntarily into the Militia, particularly if they see a chance of getting a large payment for joining as a substitute.

Major ANDERSON, in reply, said: Lord Wemyss accuses the paper of being harsh as regards the ballot, but as far as I can gather he proposes to ballot upon everybody, and I must own my only reason for bringing substitutes in at all was to try and lessen the severity of the working of the ballot. We all know the difficulty we have to contend against, that is the difficulty of leading the nation to accept this very ballot. Doubtless foreigners, as Major McDonnell has stated, get very high efficiency, but it is by dragging the nation through fearful difficulties, in fact ruining it in other ways. If this question ever again comes before Parliament, what we must think of will be every possible way in which we can smooth down that harsh word the ballot and the working of it. If we can get the men in any other way by all means let us get them, but what the nation requires is the men,

one way or the other, and the ballot is the last resource. Of course a money exemption is a very bad thing and not to be advocated, not so substitutes, fairly worked out, and I think it would be most unpopular in the country if there was no such provision, especially when we consider that if a man of education could not get into the Volunteers he might be driven to serve in the ranks of the Militia. Of course you might get out of it by the German one-year system, or some provision of that sort; the suggestion as to substitutes was only put forward by me because we find it in George the IIIrd's Ballot Act, and because we must think of every little loophole to make the ballot palatable. As regards the levies which Major McDonnell spoke of, of course we should have a certain organization to attach our rapidly raised levies to if England were invaded, but at that moment, as you will all allow, the Ballot Bill will be put in force and we shall get men who never touched a rifle, who would then be in exactly the same position as regards training as the Garde Mobile of France.

Major McDONNELL: What I said was that these untrained men would have had some kind of organization to fall into, that the recruits would go naturally to the regular volunteer battalion, and that those battalions the French had not got for them to go to, their territorial organization was not complete.

Major ANDERSON: I of course was arguing that the man as he came to us would be but a raw recruit; and as regards the cost of the force, my reason for pointing out that there would be a saving, was because as I mentioned in the Act of George IIIrd, there were 41,000 Militia; we require 142,000, and I cannot help thinking by degrees we could do with a good many less. There would be more Volunteers, the Yeomanry might also be increased, and a corresponding reduction made on the Militia, while if you shorten the Militia service and run the men more quickly into the Reserve, the reduction might be still greater; that is supposing we get the efficiency in a shorter time, I think a saving could be effected in that way.

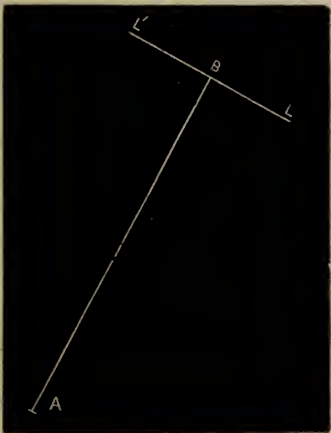
The CHAIRMAN: I must express my regret that the lecturer having prepared a very able paper has not had a larger audience; however, as Lord Wemyss has said, in the middle of Ascot week we cannot expect anything better. Major Anderson has evidently studied, and studied in a very intelligent way, the great question which should be before the minds of all Englishmen who love their country, that is, whether the military forces of the Crown are adequate to the very great requirements which would be laid upon them in case of hostilities breaking out; and I think he has come to the only conclusion which would present itself to the mind of any thoughtful Officer like himself, and that is that those forces are not adequate. Then like a sensible man he does not stop short with that conclusion, but having established to his own satisfaction, and I think to the satisfaction of all who have listened to his paper, that there are great shortcomings in our military system, he proceeds to propose remedies for the evils which exist, and foremost amongst those remedies is the enforcement of the ballot. I say enforcing the ballot, because by the law of the land the ballot is already in existence, being as you know suspended by an Act of Parliament passed every year. I quite agree with what Lord Wemyss has said—most soldiers do—I do not think I ever met with one that did not—that the ballot is at the foundation of our military system; but unfortunately from the pressure of political circumstances we have never yet had a Government—I say this without respect to party politics—we have never yet had a Government that has had—may I say the courage?—to propose the enforcement of the ballot, and I am afraid we should have to wait many a long day before we see such a phenomenon in this country. However, the defence of the Empire cannot wait for that, and therefore it behoves us all who are interested in the safety of the nation to cast about for means of making the military forces of the country as efficient as possible on the present military system, which is based on voluntary service. Major Anderson has said in regard to home defence that he cannot look upon the Volunteers as the first line of defence. Well, I do not quarrel about the question whether they are the first line of defence or the second or third (it does not matter what order they may be placed in); but I must say that in existing circumstances,—in case of an invasion of this country, we should have to depend very materially upon our citizen army, and that citizen army is already in a very fair state of efficiency

for the purposes for which it was intended. It has this admirable feature in its organization, that it admits of almost indefinite expansion. Now I wish to guard myself against being understood as saying anything in disparagement of the Militia, for I have the highest opinion of its value, and I quite assent to what has been said in regard to its being the backbone of the military forces of the Crown, but in speaking of the Volunteers, I think that in existing circumstances we should be careful to foster them in every way possible, and it is highly to be lamented that they have not had greater encouragement than is given to them at the present time. It requires the expenditure of a very small sum in addition to which they already receive to make the force much more valuable than it is. We want a volunteer reserve, and we should raise corps representing the different departments of the Army, such as Transport Corps, Medical Staff Corps, Commissariat Corps. All that might be done without adding scarcely a penny to the estimates. Then, again, there should be a great improvement in the musketry instruction. We should have the musketry instruction of Volunteers made a reality, which it hardly is at present. Of course we see that there an expenditure of money would be required, but whatever is required for the force should be given cheerfully by the Government, and it is a very poor policy that refuses to do this. We can only hope that the question of the ballot will come up at some future time, but as things stand at present we must be content with voluntary service being the foundation of our military system. It is very easy, however, for every one of us to foresee that circumstances might arise to necessitate a resort to the ballot; and, therefore, I think Major Anderson deserves well of his country for having brought this question forward for consideration, and I am sure that I shall be acting in accordance with the sentiments of all here present when I tender to him the expression of our cordial thanks for the very important paper he has read to us.

TO FIND THE DEVIATION OF A RIFLE BULLET DUE TO THE ROTATION OF THE EARTH.

By J. H. C. DALTON, B.A., Trin. Coll., Cambridge.

Let A denote the firing-point.
 B the centre of the target.
 LBL' a horizontal line on the target.



For the purposes of this problem we may consider A and B to have the same level, and the earth itself to be a sphere.
 Let the radius of this sphere be a .

Let λ, l be the latitude and longitude of A;
 and $\lambda + d\lambda, l + dl$ „ „ B:

the positive direction of measurement being to the north and east respectively.

Let R denote the range AB.
 Let α denote the inclination of the target to the east, the direction BL being the positive direction of the target.
 Let w denote the angular velocity of the earth about its axis; and t the time of flight of the bullet.

We see—

$$\begin{aligned} R \cos \alpha &= \text{resolved length of range north and south} = a d\lambda, \\ R \sin \alpha &= \text{„ „ „} = a \cos \lambda dl \quad (1.) \end{aligned}$$

On account of the rotation of the earth, the points A and B are moving with velocities $a \cos \lambda . w$ and $a \cos (\lambda + d\lambda)w$ in the direction west to east; if, therefore, we wish to determine the effect of the earth's rotation on a bullet travelling along AB, we must first determine the velocity of B relative to A; this, multiplied by the time of flight (t) will give the motion of B relative to A during the passage of the bullet; and, therefore, if we reverse this motion, we shall get the displacement of the bullet on the target.

Since the velocity of B to the east is $a \cos (\lambda + d\lambda) . w$ and of A $a \cos \lambda . w$, the relative velocity of B with respect to A is compounded of a velocity $a \cos (\lambda + d\lambda) . w$ to the east at B and $- a \cos \lambda . w$ to the east at A, and the angle between these two directions is obviously equal to $d\lambda$, the difference in longitude.

Hence, resolving along the tangent and normal to the circle in which B rotates about the axis of the earth; we get respectively,

$$\begin{aligned} \text{Along tangent } \{a \cos (\lambda + d\lambda)w - a \cos \lambda . w\} \cos d\lambda &= - a \sin \lambda w d\lambda \\ \text{Along normal } a \cos \lambda . w \sin d\lambda &= aw \cos \lambda . d\lambda. \end{aligned}$$

This latter direction will be downwards in the perpendicular from B on the axis of the earth. Hence resolving it along the north and upwards, we get—

$$\begin{aligned} \text{Velocity northwards} &= aw \cos \lambda d\lambda \sin \lambda = aw \cos \lambda \sin \lambda d\lambda, \\ \text{,, upwards} &= - aw \cos \lambda d\lambda \cos \lambda = - aw \cos^2 \lambda d\lambda. \end{aligned}$$

Hence from (1) we get—

$$\begin{aligned} \text{Velocity of B relative to A. Eastward} &= - wR \cos \alpha \sin \lambda. \\ \text{Northward} &= + wR \sin \alpha \sin \lambda \quad (2). \\ \text{Upward} &= - wR \cos \lambda \sin \alpha. \end{aligned}$$

Since the time of flight is t , the motion of B during this time (provided t be small) will be composed of these three quantities (2) multiplied by t . If, therefore, we wish to find the displacement of the bullet on this time t , we must reverse the motion; that is, we get—

$$\begin{aligned} \text{Displacement of bullet eastward} &= Rwt \cos \alpha \sin \lambda. \\ \text{,, ,, northward} &= - Rwt \sin \alpha \sin \lambda. \\ \text{,, ,, upward} &= Rwt \sin \alpha \cos \lambda. \end{aligned}$$

To find where the bullet will be on the target (on the supposition it would arrive at B in the time t , if the earth did not rotate) we must resolve along the target.

We get at once—

$$\begin{aligned} \text{Displacement to right of target} &= Rwt \sin \lambda (\cos^2 \alpha + \sin^2 \alpha) = Rwt \sin \lambda \\ \text{,, upward} &= Rwt \cos \lambda \sin \alpha. \\ \text{,, forward} &= Rwt \cos \alpha \sin \alpha \sin \lambda - Rwt \sin \alpha \cos \alpha \sin \lambda \\ &= 0. \end{aligned}$$

That is—

$$\begin{aligned}\text{Displacement of bullet to right} &= Rwt \sin \lambda & (A). \\ \text{,, ,, upward} &= Rwt \cos \lambda \sin \alpha & (B). \\ \text{,, ,, forward} &= 0 & (C).\end{aligned}$$

From these we deduce—

(1.) The time of flight is always unaltered. This we also see from the fact that the distance AB remains constant.

(2.) The lateral deviation is always equal to $Rwt \sin \lambda$, no matter what the direction of the range is. Hence we see for the same distances it varies as the sine of the latitude, and is to the right on the northern and to the left on the southern hemisphere; being zero at the equator.

(3.) The vertical deviation is always upward when the targets are more easterly than the firing-point; and the maximum deviation is when the range is due east and west, being then equal to $Rwt \cos \lambda$. Hence the greatest possible vertical deviation is at the equator. This deviation is zero always at the poles and also in any range due north or south.

Numerical Calculations.

Example 1.—The latitude of Wimbledon is $51^\circ 25'$. To calculate the lateral deviation of a bullet at 1,000 yards, the time of flight being supposed three seconds. Let δ denote the displacement.

We have shown—

$$\delta = Rwt \sin \lambda.$$

Take a second the unit of time, and 1 inch the unit of length—

$$\text{Then } R = 36000 \quad w = \frac{2\pi}{24 \times 60 \times 60} \quad t = 3 \quad \lambda = 51^\circ 25' \\ \pi = 3.14159$$

Hence—

$$\delta = \frac{36000}{12 \times 3600} \quad 3 \cdot \pi \sin \lambda = \frac{25}{10} \pi \cdot \sin \lambda,$$

Therefore—

$$\log \delta + 10 = \log 25 + \log \pi + L \sin 51^\circ 25' - \log 10.$$

Now—

$$\begin{aligned}\log 25 &= 1.39794 \\ \log \pi &= 0.4971509 \\ L \sin 51^\circ 25' &= 9.8930412 \\ \log 10 &= 1\end{aligned}$$

Hence—

$$\begin{aligned}\text{Log } \delta &= 0.7881321 \\ \therefore \delta &= 6.14\end{aligned}$$

That is, deviation is 6.14 inches to the right.

Note.—This result is correct to about $\frac{1}{1000}$ th of an inch.

Example 2.—Calculate the maximum vertical derivation of a range as in Example 1.

This will be when the range faces east or west.

Here $\alpha = 0$ or π .

Hence deviation is—

$$\begin{aligned} &= Rwt \cos \lambda \\ \text{i.e., } \delta &= Rwt \cos \lambda \\ &= 3600 \cdot \frac{2\pi}{24 \times 60 \times 60} \cdot 3 \cdot \cos 51^\circ 25' = \frac{25}{10} \pi \cos 51^\circ 25'. \end{aligned}$$

Hence—

$$\log \delta + 10 = \log 25 + \log \pi + L \cos 51^\circ 25' - \log 10.$$

Now—

$$\begin{aligned} \log 25 &= 1.3979400 \\ \log \pi &= 0.4971500 \\ L \cos 51^\circ 25' &= 9.7949425 \\ \log 10 &= 1 \end{aligned}$$

Hence—

$$\log \delta = 0.6900325.$$

Hence—

$$\delta = 4.9 \text{ inches.}$$

Example 3.—To find the horizontal and vertical displacement of the bullet on the 1,000 yards range at Wimbledon.

Given inclination of range is to the north-west, making an angle of $70^\circ 20'$ with the north.

Here we have $\alpha = -70^\circ 20'$.

Therefore—

$$\begin{aligned} \text{vertical deviation} &= Rwt \cos \lambda \sin \alpha \\ &= -Rwt \cos 51^\circ 25' \sin 70^\circ 20'. \end{aligned}$$

If therefore δ denote the numerical deviation,

$$\log \delta + 20 = \log 25 + \log \pi + L \cos 51^\circ 25' + L \sin 70^\circ 20' - \log 10$$

Now

$$\begin{aligned} \log 25 &= 1.3979400 \\ \log \pi &= 0.4971500 \\ L \cos 51^\circ 25' &= 9.7949425 \\ L \sin 70^\circ 20' &= 9.9738971 \\ \therefore \log \delta &= 0.6639296 \end{aligned}$$

Hence—

$$\text{vertical deviation} = -4.61 \text{ inches,}$$

that is it is downwards, and equal to 4.61 inches.

And—

Horizontal deviation we have seen in Example 1 is 6.14 inches to the right.

We will next determine the correction in elevation and windage necessary to keep the bullet in its right place.

Let θ denote the circular measure of and n the number of minutes in the small angle of elevation (or windage) necessary to correct a small vertical (or horizontal) displacement on the target.

We have at once if δ denote a displacement—

$$\delta = R\theta = R \frac{n}{60} \frac{\pi}{180}$$

$$\therefore n = \frac{60}{R} \frac{180}{\pi} \delta.$$

Hence, if n_t denote the number of minutes of elevation, n_w the number of minutes of windage required to counteract the vertical and lateral deviation,

We have—

$$\begin{aligned} n_t &= \frac{60}{R} \cdot \frac{180}{\pi} \cdot Rwt \cos \lambda \sin \alpha. \\ &= \frac{60}{R} \cdot \frac{180}{\pi} \cdot R \cdot \frac{2\pi}{24 \times 60 \times 60} \cdot t \cos \lambda \sin \alpha. \\ &= \frac{1}{4} t \cos \lambda \sin \alpha. \\ n_w &= \frac{60}{R} \cdot \frac{180}{\pi} \cdot Rwt \sin \lambda. \\ &= \frac{60}{R} \cdot \frac{180}{\pi} \cdot R \cdot \frac{2\pi}{24 \times 60 \times 60} \cdot t \sin \lambda. \\ &= \frac{1}{4} t \sin \lambda. \end{aligned}$$

From this we see—

The amount of correction required is independent of the length of the range, depending only on the time of flight of the bullet; that is, if a bullet from one rifle at 1,000 yards were to arrive at the target in the same time as a bullet from another at 800 yards, the same correction would be required for both the rifles at their respective distances.

Example 1.—Find the windage correction for any range at Wimbledon, for a rifle, assuming the t time of flight to be three seconds.

We have at once—

Correction in minutes = $-\frac{3}{4} \sin 51^\circ 25' = -0.53'$ (about 32"),
i.e., we must put on 32" of windage to the left.

Example 2.—Find the elevation correction for a range parallel to the 1,000 yards at Wimbledon, the time of flight being the same.

The direction of the range is supposed to be the same as in example (3).

We have—

$$\begin{aligned}\text{Correction in minutes} &= \frac{3}{4} \cos 51^\circ 25' \sin 70^\circ 20', \\ &= 0.42 \text{ (about } 25''),\end{aligned}$$

i.e., we must put on 25'' of elevation.

OCCASIONAL PAPER.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE ENGINEER ARM IN CONTINENTAL ARMIES.

By Capt. W. A. H. HARE, R.E., D.A.Q.M.G.

THE AUSTRO-HUNGARIAN EMPIRE.

INTRODUCTORY.

IN the Austro-Hungarian Army the Engineer arm of the service is, for some unaccountable reason, separated into two branches, styled "Engineers" (*Genie Waffe und Genie Truppe*), and "Pioneers" (*das Pionnier Regiment*). The Engineers consist of a Corps of Engineer Officers (*Genie Waffe*) and 2 Regiments (*Genie Truppe* or *Genie Regimenter*) officered from it, and the Pioneers consist of a single Regiment.

Though the duties of these two branches are in many ways so alike, in some cases in war indeed precisely the same, they are nevertheless kept perfectly distinct. Engineer Officers are supposed to undertake the construction and maintenance of all military works and buildings in peace, and in war the Engineer Corps would have to undertake all works connected with the attack and defence of fortified places, fortification in all its branches, demolitions, the construction, repair, and maintenance of roads, bridges, railways, &c., and technical works connected with camps and cantonments; whereas the Pioneer Regiment is supposed to undertake in war bridging in all its branches, demolitions on a small scale, the construction, repair, and maintenance of roads, railways, &c., field fortification, and the water supply of field-works.

The only thing to be said is that it is difficult to conceive how such a dual system should have so long survived the constant reorganization through which the Austrian Army has passed, and there are as yet no signs of its being interfered with.

There is another branch, which may be called an Engineer service, and which was until recently undertaken by both the Engineers and Pioneers, and that is the Railway and Telegraph Regiment. It is now a distinct service, and has been fully described in vol. xxix (1885), No. CXXVIII, p. 257 of the Journal.

Before going any further, it will be well to give a slight sketch of the Austro-Hungarian military organization.

The territory of the Austro-Hungarian Empire, which was formerly divided into 16 Military Commands, differing all in size and importance, is now divided into 15 Army Corps Commands and one independent Military Command (Zara for Dalmatia). Of these 15 Army Corps, 8 are recruited in cis-Leithian, and 6 in trans-Leithian Provinces, in other words, 8 may be said to be Austrian, and 6 Hungarian. The 15th Army Corps, comprising both Austrian and Hungarian elements, is stationed in Bosnia and Herzegovina.

This territorial organization of the Austro-Hungarian Army is supposed to be based on questions of recruiting and the grouping of Brigades and Divisions.

On mobilization, each Army Corps Territorial District is supposed to form an Army Corps complete in all respects from the troops quartered in its rayon with some slight exceptions.

The following are the Headquarters and Territorial Districts of the various Army Corps :—

| Army Corps. | Headquarters. | Territorial Rayons. |
|-------------|-----------------|---|
| 1st..... | Cracow..... | Western Galicia. |
| 2nd | Vienna..... | Upper Austria, Lower Austria and Salzburg. |
| 3rd | Gratz | Styria, Carinthia, Carniola, Istria, Trieste, Goritz, and Gradiska. |
| 4th | Buda-Pesth... | Hungary. |
| 5th | Presburg | Hungary. |
| 6th | Kaschau | Hungary. |
| 7th | Temesvar | Hungary and Banat. |
| 8th | Prague | Western Bohemia. |
| 9th | Josephstadt ... | Eastern Bohemia. |
| 10th | Brünn | Moravia and Silesia. |
| 11th | Lemberg | Eastern Galicia and Bukovina. |
| 12th | Hermannstadt | Transylvania. |
| 13th | Agram | Croatia and Slavonia. |
| 14th | Innsbruck ... | The Tyrol and Vorarlberg. |
| 15th | Serajevo | Bosnia and Herzegovina. |

The Military Command of Zara has its Headquarters at that place, and comprises Dalmatia.

The number of Infantry Divisions, Cavalry Divisions or Brigades, Artillery Brigades, and Battalions of Engineers or Pioneers, varies, however, in each Army Corps district, and thus the territorial organization of the Austro-Hungarian Army is seen at a glance, without going into detail, to be by no means so perfect as the German, from which it is copied.

Confining our remarks in the present article to the Engineer Arm, we find that instead of each Army Corps having its own Engineer or Pioneer Battalion, or whatever we choose to call it, permanently quartered in peace in its own rayon (or at any rate very near it), and permanently belonging to it in peace or war, as is the case in Germany, in Austria the Engineers and Pioneers have no such connection, and what makes it worse is that both these branches are necessary, according to Austrian ideas, in a complete Army Corps on a war footing. Thus 2 Battalions of Engineers are quartered in the 1st Army Corps district; 3 Battalions of Engineers and 2 of Pioneers in the 2nd do.; 1 Battalion of Pioneers in the 3rd do.; 2 Battalions of Engineers in the 4th do.; 1 Battalion of Pioneers in the 5th do.; 1 Battalion of Engineers and 1 Battalion of Pioneers in the 8th do.; 2 Battalions of Engineers in the 10th do.; and none in the 6th, 7th, 9th, 11th, 12th, 13th, 14th, and 15th Army Corps districts or the Zara Command.

The Permanent Headquarter Staff of an Army Corps (*Corps-Commando*) comprises in the first place the *Feldzeugmeister*, *General de Cavallerie*, or *Feldzeugmeister-lieutenant* in command, his aide-de-camp (*Personal Adjutant*), and the Chief of the General Staff. The Staff itself is divided into 2 Branches. The first, the Military Branch (*Militär-Abtheilung*), consists of 6 or more Officers of the General Staff or Officers attached, under the presidency of the Chief of the General Staff; and the second (the *Hilfsorgane*, or advising heads of Departments), comprises the Director of Artillery (*Artillerie-Director*, a Colonel, as a rule, of the Artillery Staff), the Commanding Engineer (*Genie-Chef*, a Colonel, as a rule, of the Engineer Staff), the Judge Advocate (*Justiz-Referent*), the Principal Medical Officer (*Sanitäts-Chef*), the Chaplain (*Militär-Pfarrer*), and the Chief of the Intendanz (*Intendanz-Chef*).

Of the 15 Army Corps that exist in peace, 3 only, viz., the 2nd (Vienna), the 3rd (Gratz), and 15th (Serajevo), have three Divisions, as laid down for the Army in the Field; the remainder, with the exception of the 14th (Innsbruck) which has only 1 Division, and the Zara Command which has a special formation of its own, have only 2 Divisions each, and no doubt in case of war would receive each a Landwehr or Honved Division.

The first 13 Army Corps would be formed, in all probability in case of hostilities on a large scale, into 3 Armies. One of these would probably have 5, and the other two 4 Army Corps each. The 14th Army Corps, intended for the defence of the Tyrol, would be organized for mountain warfare, and would comprise two Divisions, one of regular troops and the other of *Landesschützen* (Tyrolese Reserve). The 15th Army Corps and the troops of the Zara Command are not supposed to form part of the mobilized Field Army, but are intended for the local defence of Bosnia, Herzegovina, and Dalmatia.

The Generals Commanding the 3rd (Gratz), 4th (Buda-Pesth), and 8th (Prague) Army Corps are of very high rank, and would take command of the three Field Armies that would be formed. They are styled *Corps Commandant und Commandirender General*, and have *Stellvertreter*, or Generals second in command under them. The latter would take command of the Army Corps on mobilization.

The troops that would be comprised in the "ordre de bataille" of the mobilized Field Army are for the greater part grouped in peace in Divisions.

There are nominally 31 Infantry Divisions with permanent Headquarters in peace, numbered from 1 to 36. Nos. 20, 21, 22, 23, and 26 do not exist in peace, and would only be formed on mobilization with Landwehr and Honved troops. 12 entirely new Divisions would also be formed on mobilization; 2 of these only would be of regular troops,¹ 9 would be of Landwehr or Honved troops, and 1 (the 48th) of *Landesschützen* of the Tyrol and Vorarlberg.

The total number of Infantry Divisions available in case of war would then nominally, at any rate, be 48.

The cavalry of the 1st and 11th Army Corps only are formed in Cavalry Divisions. The remainder are in Brigades.

An Infantry Division consists as a rule of two Brigades. Divisions intended for mountain warfare comprise 3 or 4 Mountain Brigades. Cavalry Divisions are of two Brigades each.

On a war footing an Infantry Division would consist of—

- a. A Divisional Staff (*Truppen-Divisions-Commando*).
- b. 2 Brigade Staffs.
- c. 2 Rifle or Infantry Battalions.

¹ These, the 44th and 47th Divisions, were actually mobilized in 1882 for the suppression of the insurrection in Dalmatia and Herzegovina.

d. 12 Infantry Battalions (in two Brigades).

e. 2 to 4 squadrons of Cavalry.

f. A Battery division (4 Batteries).

g. A company of Engineers;

with a nominal fighting strength of some 13,000 bayonets, 600 sabres, and 24 guns.

A Cavalry Division consists of 2 or 3 Cavalry Brigades, or from 4 to 6 Regiments, with a division of Horse Artillery (2 Batteries).

An Army Corps would comprise—

a. An Army Corps Staff (*Corps-Commando*).

b. 2 or 3 Infantry Brigades complete.

c. A Cavalry Brigade.

d. The Corps Artillery (2 Battery divisions).

e. The necessary number of Pioneers¹ and Bridge Trains, as a rule a Company with 2 Bridge Trains (*Kriegsbrücken-Equipagen*) and an Advanced Guard Bridge Train (*Vorhut-Brücken-Train*).

The Cavalry Brigade would furnish the Divisional Cavalry.

This is omitting such details as Staff escorts, trains, ammunition column &c., &c.

PART I.—THE ENGINEERS.

THE CORPS OF ENGINEER OFFICERS.

Organization.

The Officers of the Corps of Engineers, called in Austria the *Genie Waff*, are all borne on one list, comprising General Officers, Colonels, Lieutenant Colonels, Captains, Lieutenants, and Cadets, under an Inspector-General of Engineers (*General-Genie-Inspector*). The Major-Generals (9) are, with the exception of two employed at the War Ministry, all Commanding Engineers of Army Corps. The Field Officers and Captains (First and Second Class) are shown as either belonging to the Engineer Staff (*Genie Stab*), or doing duty with the Engineer Regiments. Below the rank of Second Class Captain all Officers belong to the Regiments.

The *Stab* comprises besides the Generals, some 20 Colonels, 21 Lieutenant Colonels, 21 Majors, 66 First Class Captains, and 20 Second Class Captains. The Regimental Officers comprise 2 Colonels, 4 Lieutenant-Colonels, 8 Major 52 First Class Captains, 32 Second Class Captains, 166 First Lieutenant 228 Lieutenants, and 5 Cadets, including Officers in the Reserve.

The total number of Officers in the corps is given in the Army List of 1895 as—

1 Lieutenant-General (*Feldmarschal-Lieutenant*).

9 Major-Generals.

22 Colonels.

25 Lieutenant-Colonels.

29 Majors.

118 First Class Captains (including 7 in the Reserve).

52 Second Class do.

166 First Lieutenants (including 6 in the Reserve).

228 Lieutenants (including 107 in the Reserve).

5 Cadets, all in the Reserve.

The Captains and Subalterns in the Reserve are all shown as belonging to the Regiments. Though all Officers below the rank of Second Class Captain are

¹ The Pioneers are the pontoneers of the Austro-Hungarian Army.

shown as Regimental Officers, there are, nevertheless, a good many of these not doing duty with the Regiments. For instance, 1 Major is returned as attached to the Railway and Telegraph Regiment, and 11 Captains as belonging to Engineer Directions (*i.e.*, on command with the Engineer Staff), or attached to the General Staff, Training Establishments, &c. There are also some 41 First Lieutenants (chiefly among the seniors) and 2 Second Lieutenants attached to Engineer Directions, 4 First Lieutenants attached to the General Staff, 2 First Lieutenants to Military Training Establishments, 1 First Lieutenant to the Intendanz, and 1 do. to the Technical and Administrative Military Committee. This shows that the actual number of doing-duty Engineer Officers with the Engineer Regiments is some 2 Colonels, 4 Lieutenant-Colonels, 7 Majors, 60 First and Second Class Captains, and 223 First and Second Lieutenants, or 296 of all ranks. The two Regiments on a peace footing require, according to establishment, some 250 Engineer Officers of all ranks, and it would therefore appear that the Regiments are fully officered.

According to the original Regulations of the Engineers, no Officer could be placed on the *Genie Stab* unless he had passed the advanced Engineer Class with distinction, but though these Regulations are nominally still in force, they were practically put aside in this respect by the Regulations of the 5th April, 1880, by which all Engineer Officers may be employed without distinction either on the Engineer Staff or with the Engineer Regiments.

The Officers of the Engineer Regiments and Staff now form one Corps, or constitute what is called in the Austrian Service a *Concretual Stand* for promotion, &c. It is laid down in the Regulations that an Engineer Officer must be equally fitted for duty with the Regiments or the Staff, and that care is to be taken, in selecting Officers for employment, that they are not too exclusively employed in one branch.

Officers of the Engineer Regiments and Engineer Staff wear the same uniform, with the difference that the former wear the schako and the regimental number (1 or 2) on the buttons, whereas the latter wear the cocked hat with black feathers and plain buttons. The tunic or patrol jacket (*Blouse*) is light blue with cherry-red velvet facings, and the trousers blue-grey with cherry-red seams.

Appointment and Promotion.

Appointment to Lieutenant is made as in the Artillery from students of the Technical Military Academy (*Technische-Militär-Akademie*) at Vienna, or from Acting-Officer-Cadets socially and otherwise fit for the rank. In the Engineers the proportion of the latter is very small.

The Technical Military Academy prepares students for commissions in the Artillery, Engineers, and Pioneers, and every annual batch of students is divided into Artillery and Engineer classes. The nominal number of students at the Establishment is 200. The course of study lasts three years. There is also a preparatory school for the Academy—the *Militär-Ober-Real Schule*—at Weisskirchen in Moravia with a nominal establishment of 450 pupils.

Cadets must serve at least one year before being eligible for a commission, and be accepted by the Officers of the Regiment as socially and otherwise fit for the same.

Cadets join the Engineer Regiments from the Engineer Cadet School (*Genie-Cadeten-Schule*) at Vienna, which has an establishment of thirty students.¹

¹ There are 12 Cadet Schools in various parts of the Empire for the Infantry, 1 at Weisskirchen for the Cavalry, 1 at Vienna for the Artillery, 1 at Vienna for the

There are no cadets on the active list of the Engineers at present, and only five in the Reserve, so that appointment to Lieutenant in the Engineers is practically confined to successful students from the Academy.

To complete the higher technical training of Engineer Officers, there is an advanced Engineer class (*Höherer-Genie-Curs*) at Vienna, which, with the advanced Artillery class, is under the Technical Administrative Military Committee. The course last two years. Officers to be admitted to it must have not less than two years' service and be below the rank of Second Class Captain. Captains to qualify for promotion to Field Officer may, however, under certain circumstances, be allowed to attend the course.

The Officers studying in the advanced Engineer class in 1885 are given as 13 Captains (First and Second Class), and 24 First Lieutenants.

Captains need not pass the entrance examination to attend the class. Any Captain may pass the final examination of the course without having attended it, and under certain circumstances, if he fails, may be allowed a second trial.

Promotion from Lieutenant to Captain goes according to the "qualification lists." Promotion from Second to First Captain goes by seniority.

A Captain must have passed the final examination of the advanced Engineer class to be promoted to Field Officer.

Promotion in the Engineers is guided by the same Regulations as in the other arms, that is to say, by seniority (*tourlich*), provided the Officer qualifies, and by selection (*ausser-tourlich*) if the Officer have special qualifications. Below the rank of Field Officer one step in every six may be given by selection, and in the higher ranks one in every four. Engineer Officers to be promoted by selection must have passed the final examination of the advanced class with distinction.

The Inspector-General of Engineers.

(*General Genie-Inspector.*)

The Engineers are under an Inspector-General of Engineers (*General Genie-Inspector*) at the War Ministry. He is assisted by a Colonel and a Captain of Engineers. His chief duties are to advise the War Minister on all questions connected with the Engineer service, the training of the Engineer troops, and the promotion and transfer of Officers and their distribution in the event of hostilities.

There is a Commanding Engineer (*Genie-Chef*) on the Staff of each Army Corps district and the Zara Command, acting in the capacity of assistant or adviser (*Hilfsorgan*) to the General in command. He has charge of all fortifications and military buildings in the command, as well as the technical and administrative supervision of all military works carried on by the "Engineer Directions" under him. He is assisted by a Field Officer as Executive Officer.

The Technical and Administrative Committee at the War Ministry.

There is a Technical and Administrative Committee (*Technisches und Administratives Comité*) at the War Ministry directly under the War Minister, which is supposed to deal with all questions of a scientific, technical or administrative nature. It is under the presidency of a Lieutenant General assisted by six Officers of various ranks of the Artillery Engineers, Pay Department, &c., and is divided into four Sections. The

Engineers, and 1 at Hainburg for the Pioneers. The Engineer Cadet School is by far the smallest.

first deals with Artillery matters, the second with Engineer matters, the third with Intendance matters, and the fourth with matters of a technological nature. Each Section has its Chief (*Section-Chef*) and is further divided into *Abtheilungen* or departments, each with its *Vorstand* or head. The second Section is divided into three such *Abtheilungen*, and gives employment to 14 Engineer Officers of various ranks and 2 Professors. There are besides 3 Engineer Officers employed on the Staff of the President and in the fourth Section, making 17 employed on the Committee in all.

The training establishments for Officers of the Artillery and Engineers are also under the supervision of the Committee.¹

The Engineer Department at the War Ministry.

The 8th Department (*Abtheilung*) of the War Ministry has the general administrative supervision of the working of the Engineer Directions and establishments, and has administrative charge of the stores and *matériel* belonging to the Engineers, Pioneers, and Railway and Telegraph Regiment.

It is under a Major-General of Engineers, and gives employment to some 9 Engineer Officers of various ranks and 4 *Beamte* (*employés* with relative Officers' rank).

Duties of Officers of the Engineer Staff in Peace.

In the reorganization of the Engineers that took place in 1869, the construction and maintenance of barracks and military buildings was transferred to a special department styled the *Militär-Bau-Verwaltungs-Officiers-Corps*, the *personnel* of which consisted of Engineer Officers, Officers of the other arms, and retired Officers, leaving the construction and maintenance of fortifications alone to the Engineer Staff.

By an order of the 9th July, 1876, however, the first named department was done away with, and its duties again handed over to the Engineer Staff.

There are still, however, 1 Colonel, 1 Lieutenant-Colonel, 2 Majors and 17 First and Second Captains of the *Militär-Bau-Verwaltungs-Officiers-Corps* remaining. They are attached permanently or otherwise to the *Genie Stab*. They wear a uniform like the latter, but the buttons are white instead of yellow.

Engineer Directions.

In the territory comprised in each Army Corps district there are one or more Engineer Directions with offices in the most important military garrisons. They are in each case under the General Commanding the Army Corps of the district as regards military and *personnel* matters, and under the Commanding Engineer (*Genie-Chef*) of the district in technical and administrative business.

Each Direction is under a Director (*Genie-Director*)—a Field Officer or Captain of the Engineer Staff—assisted by a certain number of Officers and *employés* (*Militär-Bau-Rechnungs Beamte*) corresponding to our clerks, surveyors, foremen of works, &c.

When works are undertaken on a large scale it is usual to form a special "Direction" for the purpose.

¹ This Committee was created on the Engineers being reorganized in 1869. Before this, there were two distinct Committees, one for the Artillery and the other for the Engineers, quite independent of each other, dealing with all questions of either arm in technical, scientific, and *personnel* matters.

The present arrangement of the permanent Engineer Directions is as follows :—

| Army Corps. | Headquarters. | Engineer Directions. |
|------------------------------|------------------|--|
| 1st..... | Cracow..... | Cracow, Przemyśl. |
| 2nd | Vienna..... | Vienna, Linz. |
| 3rd | Gratz | Gratz, Klagenfurt, Trieste, Pola. |
| 4th | Buda-Pesth..... | Buda-Pesth, Fünfkirchen. |
| 5th | Presburg | Presburg, Komorn. |
| 6th | Kaschau | Kaschau. |
| 7th | Temesvar..... | Temesvar, Arad. |
| 8th | Prague | Prague, Budweis. |
| 9th | Josephstadt..... | Josephstadt, Theresienstadt. |
| 10th | Brünn | Brünn, Olmütz. |
| 11th | Lemberg | Lemberg, Ozernowitz. |
| 12th | Hermannstadt... | Hermannstadt, Karlsburg. |
| 13th | Agram | Agram, Esseg, Peterwardein. |
| 14th | Innsbruck..... | Innsbruck, Franzensfeste, Trent. |
| 15th | Serajevo | Serajevo, Dolnja-Tuzla, Gorazda, Banjaluka, Mostar, Trebinje. |
| The Military Command of Zara | | Ragusa, Cattaro. |

The Engineer Staff with the Mobilized Armies in the Field.

There would be on the Headquarter Staff of the Commander-in-Chief of the Armies in the Field (*Armee-Ober-Commando*) a General Officer of Engineers as Commanding Engineer (*Genie-Chef*), and on the Staff of the General Commanding an Army (*Armee-Commando*) a General Officer or Colonel in a similar capacity (*Armee-Genie-Chef*).

On the Staff of the General Commanding an Army Corps (*Corps-Commando*), the Commanding Engineer would be either the Officer Commanding the Battalion of Engineers, the companies of which were attached to the Army Corps, or a Field Officer of the Engineer Staff; the former would be accompanied by his Adjutant, and the latter would be given a subaltern of Engineers as an Adjutant. Under certain circumstances a Captain of the Engineer Staff would be attached to the Staff of a Division as Commanding Engineer, but not as a rule.

The Commanding Engineer in the above cases is, like the Officer commanding the Artillery, what is termed in the Austrian Service a "*Hilfsorgan*" or advising agent of the General in command.

The Commanding Engineer on the Staff of the Commander-in-Chief of the Armies in the Field would be assisted by a Field Officer, an Officer below the rank of Field Officer, and a clerk. The total establishment would be 3 Officers, 10 non-commissioned Officers and men, 2 civilians, 16 horses, and 2 two-horsed wagons.

The Commanding Engineer of an Army would be assisted by a Field Officer, 2 Officers below the rank of Field Officer, and 2 clerks, the total establishment being 4 Officers, 13 non-commissioned officers and men, 1 civilian, 15 horses, and 2 two-horsed wagons.

The Commanding Engineer of an Army Corps would be assisted by an Officer and a clerk, the total establishment being 2 Officers, 6 non-commissioned officers and men, 6 horses, and 1 two-horsed wagon.

Engineer Directions in War.

The Engineer Direction of any fortress of the Empire that might be

threatened by an enemy would be strengthened and attached to the Staff of the fortress in question. It would then form part of the defending garrison.

If necessary certain special Directions would be formed to undertake works of defence (*Befestigungs-Bau-Directionen*).

In the case of siege operations, there would be a Commanding Engineer (*Belagerungs-Genie-Chef*) appointed—a General or Colonel according to the scale of the undertaking. If the greater portion of an Army were to undertake a siege, the Commanding Engineer of that Army would be appointed to the post. There would also be under him one or more Engineer Siege Directions (*Belagerungs-Genie-Directionen*) with the Engineer Siege Park (*Belagerungs-Genie-Park*).

Reference has already been made to the anomaly of the existence of Engineers and Pioneers in the Austrian Army. The latter it should be remembered are the Pontoneers of the Austrian Army. Though the Engineers are supposed to undertake all kinds of bridging either with floating or fixed supports, bridging is looked upon more as a Pioneer than an Engineer service, and it is laid down by Regulation that if detachments or parties of Engineers and Pioneers are employed together at any bridging operation, pontoon or otherwise, the Pioneer Officer takes charge. If, however, the work be fortifying, mining, or demolition, the Engineer Officer takes charge. In all other work which forms part of the training of both Engineers and Pioneers, the Senior Officer present would take charge, unless special instructions to the contrary were given on the subject.

THE ENGINEER REGIMENTS (GENIE TRUPPE).

Peace Organization.

The *Genie Truppe* is organized in two distinct Regiments, numbered 1 and 2, and bearing besides the names of their honorary Colonels (*Regiments-Inhaber*). The 1st Regiment now bears the title of "*Kaiser Franz Joseph*," and the 2nd that of "*Erzherzog Leopold*."

Each Regiment is organized in a Regimental Staff, 5 Field Battalions of 4 Field Companies each, 2 Reserve Companies, and 1 Depôt Battalion of 5 Depôt Companies.

The Field Battalions of each Regiment are numbered 1 to 5, the Field Companies 1 to 20, the Reserve Companies 1 and 2, and the Depôt Companies 1 to 5.

In peace the Depôt Battalions exist in Cadre only, and are stationed with the Regimental Headquarters or Staff; a Depôt Company in Cadre is formed for every detached Field Battalion.

There are also 15 Intrenching Tool Columns and the Chief Engineer Park, belonging to the Engineer Regiments.

The Regimental Staff consists of a Colonel in command, an Adjutant Lieutenant, a Quartermaster (*Proviant-Offizier*), a Captain or Lieutenant Judge Advocate (*Auditor*) and a Surgeon (*Regiments-Arzt*), besides 1 non-commissioned officer clerk, 5 Officers' servants, and 4 horses.

A Field Battalion Staff consists of a Lieutenant-Colonel or Major in command, an Adjutant (Lieutenant), a Surgeon (except in the 1st Battalion), 3 Officers' servants (except in the 1st Battalion), and 3 horses.

A Field or Reserve Company is commanded by a Captain. In the case of the former there are 4 subalterns, but in the latter only one.

The Peace Establishments of a Field Reserve Company and of the 1st and 2nd Regiments are given in detail in Tables I and II.

The Colonel commands the Regiment in peace in every detail, and his duties and responsibilities are given in the "*Dienst Reglement für das K. K.*"

Heer," and in certain Special Regulations. Certain powers are, however, delegated to Officers commanding detached Battalions, such as disciplinary powers within special limits as laid down by regulation for Officers commanding detached Battalions, the distribution and employment of non-commissioned officers and men actually serving, the granting of leave to Officers and men, the transfer of non-commissioned officers and men (not interfering with promotion), certain judicial investigations, and other minor similar details. In war, Officers commanding Battalions can promote up to the rank of company sergeant-major inclusive, but in peace it remains with the Colonel in command to delegate either entirely or partially this power to the Officer commanding a detached Battalion.

The Officer commanding a Battalion is entrusted with the maintenance of military order, discipline, and the efficiency of all under his command.

He reports to the Colonel commanding the Regiment on all matters affecting the *personnel* of the Officers of his Battalion, their qualifications for promotion, and such like details.

In the case of Companies or Detachments shown as separated from the Battalion in the "*ordre de bataille*," and working under the Commanding Engineers of Army Corps or Engineer Directors, the power to promote up to the rank of company sergeant-major inclusive would rest with these Officers.

The Dépôt Battalion Cadres and detached Dépôt Company Cadres keep the rolls of their respective establishments, as well as the rolls of the Officers and men not with the colours of the Field Battalions of which they form the Dépôts; and in the case of the Dépôt Battalions, the rolls of the Reserve Companies as well.

The Officer commanding the Dépôt Battalion Cadre is under the Colonel commanding the Regiment, and the Officer commanding a Dépôt Company Cadre under the Officer commanding the Battalion to which it belongs.

The Officer commanding the Dépôt Battalion Cadre acts as President (*Verwalter*) of the Board on Stores and Equipment (*Material-Verwaltungs-Commission*); the detail as regards books and accounts, and the issue of stores, &c., in case of an augmentation, rests with the subaltern Officers. Officers commanding Dépôt Company Cadres of detached Battalions, and their attached subalterns, have similar duties; the latter would also be employed as Battalion Quartermasters (*Proviant-Offiziere*). Officers belonging to Dépôt Cadres have to attend instruction and exercises so far as their duties allow them.

The senior Regimental Paymaster (*Truppen-Rechnungsführer*) belonging to Dépôt Battalion Cadre is a member of the Regimental Administration Board (*Verwaltungs-Commission*), and the Paymaster of the detached Dépôt Company Cadre a member of the Battalion Administration Board.

The Engineer troops are, in purely military matters, under the Officers commanding the units they are shown as belonging to in the "*ordre de bataille*," but in scientific, technical, and administrative matters they are immediately under the Imperial War Ministry.

The independent detached Battalions and Reserve Companies are, except in certain matters reserved for the Colonel commanding the Regiment, under the Army Corps (or *Zara*) Commands through the Divisional and Brigade Commands they happen to belong to. When two Reserve Companies are stationed in the same place, the senior Company Commander would have the same position, in a military sense, as the senior Company Commander of a detached Half-Battalion, and would supervise the training and exercises of the Companies present.

In peace all the fractions of a Regiment, including the two Reserve Companies stationed at the same place as the Regimental Headquarters, form one corps for rations, pay, accounts, &c. (*Wirtschafts- und Verrechnungs-*

Korper), such matters being managed by the Regimental Administrative and Pay Board (*Verwaltungs- und Cassa-Commission*).

These matters are similarly performed, in the case of independent detached Battalions, by Battalion Administrative and Pay Boards with their respective Depôt Company Cadres. When two or more Battalions of the same Regiment happen to be stationed in the same place, the War Ministry decides whether they are to be treated as a single or separate corps in this respect.

Detached Companies may be treated independently in this respect under certain conditions.

The Statements of Accounts of the Engineer Troops are submitted to the Intendants of the Military Territorial Commands they happen to be in.

The Regimental General Returns and Rolls showing Reserves, &c. (*Haupt-Grundbuch*) are always kept by the Administrative Board which permanently remains with the Regimental Headquarters or, as the case may be, Depôt Battalion Cadre Headquarters.

Quarters in Peace.

The Engineer troops are distributed in peace with a view to facilitate recruiting and mobilization on the one hand, and training and exercises on the other. As a rule the distribution is a permanent one.

Of the five Battalions of each Regiment, two are stationed with the Regimental Headquarters, and the remainder elsewhere.

The following are the garrisons the Engineer troops are quartered in at present :—

1st Regiment :—

Headquarters, Depôt Battalion Cadre, and 3rd and 5th Field Battalions, at Olmütz (X Corps).

1st Field Battalion at Przemyśl (I Corps).

2nd Field Battalion at Cracow (I Corps).

4th Field Battalion at Prague (VIII Corps).

1st and 2nd Reserve Companies at Theresienstadt.

2nd Regiment :—

Headquarters, Depôt Battalion Cadre, and 1st and 3rd Field Battalions at Krems (II Corps).

2nd Field Battalion at Vienna (II Corps).

4th and 5th Field Battalions at Buda-Pesth (IV Corps).

1st and 2nd Reserve Companies at Gratz.

Recruiting.

Recruits are obtained for the Engineer Regiments by selection from the annual contingent, and in the case of drivers, bätmen, &c., by the transfer of men from the Cavalry Reserves.

The Instructions on Recruiting (*Instruktion zur Ausführung der Wehrgesetze*) give the recruiting districts from which the different Battalions obtain their respective batches of recruits.

According to the "Verordnungsblatt," No. 7 of 1883, the 1st Regiment draws its recruits as follows :—

The 1st and 2nd Battalions stationed at Olmütz and Cracow respectively, from Moravia and Silesia. The 3rd Battalion at Olmütz, the 4th Battalion at Prague, and the 5th Battalion at Olmütz, from Bohemia.

The 2nd Regiment draws its recruits—the 1st Battalion at Krems, from Styria, Carinthia, Carniola, Istria, Goritz, Gradiska, and Trieste: the 2nd Battalion at Vienna, and the 3rd Battalion at Krems, from Upper and Lower

Austria and Salzburg; and the 4th and 5th Battalions at Buda-Pesth and Koems respectively, from Hungary.

Thus Austria proper and Salzburg furnish recruits for 2 Battalions; Moravia and Silesia for 2 Battalions; Bohemia for 3 Battalions; Styria, Carinthia, Carniola, the Adriatic Coast, and Dalmatia for 1 Battalion; and Hungary for 2 Battalions.

The following are the rules followed in selecting men for the Engineers:—

The minimum standard is 1·68 metres (5 feet 6 inches), the men must be physically strong and able to read and write, or be otherwise intelligent. Especial care is taken that recruits have good sight and hearing. Recruits of superior education may be taken as short as 1·58 metres (5 feet 2 inches), or even, if they are otherwise very desirable men, at the minimum standard for the Army, viz. 1·554 metres (5 feet 1 inch). Recruits must belong to certain trades in certain proportions. Thus 40 per cent. should be masons, bricklayers, stone-cutters, miners, and smiths; 15 per cent. should be carpenters and joiners; 6 per cent. draughtsmen, fitters, and clerks; and the remainder slaters, gardeners, wheelwrights, packers, basketmakers, turners, ropemakers, painters, and bookbinders, besides shoemakers, tailors, saddlers, harness-makers, and butchers, in sufficient numbers for small complete detachments.

Recruits are called upon to join nominally on the 1st October. The contingent is distributed among the Field and Reserve Companies, keeping in every case as near as possible to the same proportion of the different trades.

In time of peace any diminutions in the strength are to be filled up at once in the case of the Dépôt Company Cadres, but in other units twice a year, viz., in the autumn when the recruit contingent joins, and in the spring, nominally on the 1st April.

Men re-engaging from year to year, having served the prescribed time with the colours, from company sergeant-major downwards, must not exceed 250 in number in an Engineer Regiment. The men given in Table V are not, however, reckoned in this.

Drivers and Officers' bâtmén and grooms are obtained every autumn, when the recruit contingent joins and the reservists granted furlough, by transfers of reserve men from Cavalry Regiments by order of the War Minister.

It is the duty of the Colonel in command to see that the necessary number of reserve men of all ranks is forthcoming in case of mobilization, with a surplus margin of 6 per cent.

The number of recruits annually required by a Regiment is about 830, so that the total number required for the Engineers is 1660.

Arms and Accoutrements.

Non-commissioned officers and men shown on the establishment as belonging to the *Feuergewehr Stand*, or armed with firearms, carry the Werndl carbine, known in the Austrian Service as the *Extra-Corps-Gewehr*. It is fitted with the old-fashioned bayonet. Those armed with carbines also carry the Pioneer's short sword, known as the *Pionnier-Sübel*. Acting-Officer Cadets wear the Infantry Officer's sword. Armourers wear the Infantry non-commissioned officer's sword. All other non-commissioned officers and men are armed with the Pioneer's sword. Non-commissioned Officers (*Unter-offiziere*) wear a sword-knot on the hilt of the Pioneer's sword.

Non-commissioned officers armed with the carbine carry 20 rounds in the field, lance-corporals and sappers 30 rounds.

The clothing is of the German¹ Infantry pattern. The tunic, blouse, and

¹ There are two patterns of uniform in the Austro-Hungarian Army, known as the "German" and the "Hungarian."

jacket are light-blue with cherry-red facings, the trousers grey-blue with cherry-red seams. The schako, forage-cap, hood, great coat, boots, belts, knapsack, haversack, water bottle, mess tin, and minor details of the kit are all of the Infantry pattern. The schako and tunic, as in the other dismounted branches of the Austrian Army, are not taken into the field, the field dress being the blouse and forage-cap.

The colour of the Officers' uniform is the same as that of the men, but the facings are of velvet. The Officer's forage cap is of a different pattern.

The buttons are yellow, with the number of the regiment. The belts are black.

The distinguishing marks for rank are the same as in the Infantry.

Training.

The theoretical and practical training of the Engineer Regiments is laid down in Training Regulations of the Austrian Army (*Instruktion für die Truppen-Schulen des K. K. Heeres, IV Theil*) and other Special Instructions. Infantry drill must be finished, in the case of a Company, by the end of June, and in the case of the Battalion, by the end of August. The technical training must also be carried on during the time the recruits get their preliminary military training in the winter months, so that by the end of June the last joined contingent may be available as workmen in field duties. The training in the case of Field and Reserve Companies is the same.

No man can be detached for any duty not regimental, before he has completed a year's service; and with a view to facilitate training, all non-commissioned officers and men on command who could claim their furloughs in September, are recalled in March, unless they are willing to re-engage for another year. In the case of those who have served their full term of three years, this need not be done.

Lance-corporals and sappers who prove themselves very efficient workmen, are given a distinguishing mark (*Arbeits-Auszeichnung*), and keep this on promotion. It is of the same form as the good shooting badge in the Infantry, and consists of a cherry-red worsted cord attached to the button of the coat, something like an aiguillette.

Non-commissioned officers and men in the Reserve of the 2nd, 4th, and 6th years' Reserve service are annually called up for training in the spring or autumn. The dates of calling out are fixed every year by the War Ministry with due regard to the harvest, &c. The periods are always well within the limits given by Article 36 of the *Wehrgesetz*. Reserve men called out for training are attached to Reserve Companies, or to Field Companies if these are in districts which furnish recruits for the Engineers.

Reserve Officers appointed from one-year volunteers are called out three times during their service in the Reserve. Reserve Officers who have been Officers proper (*Berufs-Offiziere*) are called out with their respective Reserve Contingents, but never for more than four weeks at a time. As a rule they would do duty with Field Companies at manœuvres.

The establishment (*Grundbuchstand*) of all the fractions of the Regiment are readjusted annually at the time the Reversists are furloughed, with a view to minimizing transfers and changes in the event of mobilization. In doing this the following are the main principles observed:—

The establishment of a Field or Reserve Company must show an excess in men, above its total war establishment, equal to its normal annual recruit contingent. This excess enables in the first place the Battalion Staffs to be completed and other casualties replaced on mobilization, but it is chiefly intended to enable the Field Companies to leave insufficiently trained

men behind, and yet take the field with a full war strength. The men left behind would be transferred to the *Depôt* Companies. The establishment of these comprises all the fractions and detachments given in Table V, with the exception of Intrenching Tool Column No. 3, the non-commissioned officers and men of which are borne on the strength of the 1st Reserve Company of the 2nd Regiment.

The establishment of the *Depôt* Companies should show the number of non-commissioned officers and bandsmen required for the maximum strength of the *Depôt* Companies, as given in Note c to Table III, and for the detachments, &c., given in Table V, with an excess of 6 per cent.

From the surplus non-commissioned officers and men of the Engineer Regiments, a certain number are annually transferred, by order of the War Ministry, to the establishment of the Railway and Telegraph Regiment, for service in the Field-Telegraph Detachments.

WAR ORGANIZATION.

Mobilization.

The first act is the calling out of all Officers and men in the Reserve. The Battalions are then raised to a war footing, and the *Depôt* Battalions formed together with such Staffs, Detachments, &c., as do not exist in peace.

Each Regiment would mobilize—

1. A Regimental Staff.
2. 5 Battalion Staffs.
3. 20 Field Companies.
4. 2 Reserve Companies.

Consequently there would be 40 Field and 4 Reserve Companies.

On the Regiment being mobilized for war, the Colonel receives an appointment from the War Ministry to another post, but he nevertheless retains the management of certain matters connected with the *personnel* of the Officers of the Regiment, unless prevented from doing so by his new office, in which case he would hand the business over to the Officer commanding the *Depôt* Battalion.

Each Regiment would form, on mobilization, with the Cadres existing in peace, a *Depôt* Battalion consisting of a Staff and 5 Companies, that is to say a Company for each mobilized Battalion. There would be consequently 10 *Depôt* Companies in all. These would remain in war in the places where their respective Battalions were quartered in peace.

In extreme cases 4 out of the 5 *Depôt* Companies of each Regiment might be mobilized, leaving detachments to form *dépôts*. The 1st Company would however, always remain at the Regimental Headquarters.

A *Depôt* Company would have much the same strength as a Field or Reserve Company, but unless mobilized would have no transport or horses.

On mobilization the Field Officer next senior to the Colonel takes command of the *Depôt* Battalion, and the Captains belonging to the *Dépôts* in peace would not be changed, unless for very urgent reasons. The *Depôt* Battalions and Companies take over from the mobilized Battalions and Companies the men of the last recruit contingent whose training may be incomplete, and it is then their business to continue their training, and be prepared to replace losses and casualties in the field.

As soon as the mobilized Field Battalions leave their peace garrisons and are detached from Regimental Headquarters, their respective *Depôt* Companies are, in an administrative point of view, under the Officer commanding the *Depôt* Battalion. The latter, on the departure of the Colonel, takes over the administrative management of the Regiment, and in some cases the *personnel*

matters of the Officers as well. The Regimental Adjutant becomes the Adjutant of the *Depôt Battalion*.

The Administrative Board (*Verwaltungs-Commission*) of the Regiment becomes, on mobilization, the Administrative Board of the *Depôt Battalion* (*Verwaltungs-Commission des Ersatz Bataillons*). The Administrative Boards of the Battalions not quartered with the Regimental Headquarters in peace, are broken up on mobilization, and the *Depôt Companies* of these Battalions are attached, for financial and administrative matters, to some *Verwaltungs-Commission* in the place they are stationed in.

A mobilized Battalion, when kept together, forms one corps for Pay and Accounts; but detached Companies are for such matters either attached to the Paymaster (*Truppen-Rechnungs-Führer*) of a Brigade or Divisional Staff, or the Paymaster of some Corps or Regiment.

A mobilized Battalion Staff includes the Lieutenant-Colonel or Major commanding the Battalion, but varies in total strength. A complete Staff would consist of 5 Officers, 3 non-commissioned officers, 12 drivers, servants, &c., and 11 horses. (See Tables IV and IV.)

A mobilized Field or Reserve Company would consist of 5 Officers (1 Captain and 4 subalterns), an Acting-Officer-Cadet, 28 *Unteroffiziere* and Corporals, 206 lance-corporals, sappers, and drivers, 28 horses (2 riding and 26 draught), and 6 four-horsed wagons (1 *Rüstwagen* or wagon for rations, forage, and general stores, and 5 tool and implement wagons).

The details of the Regiments when mobilized are given in Tables III, IV, and IV.

The total strength varies slightly, but would be about 167 Officers and 6,180 non-commissioned officers and men, taking the *Depôt Companies* as about the same strength as the Field or Reserve Companies.

Each Regiment taking annually a contingent of 830 men, and being able to fall back, on mobilization, on 10 classes¹ (3 with the colours and 7 in the Reserve), would, allowing for casualties, have at its disposal some 6,680 men,² with a surplus consequently of some 500 men.

There are no Landwehr Cadres for the Engineers. Reserve men passing into the Landwehr would be detailed for service in fortresses, &c., and Engineer Landwehr detachments might of course be formed in war for home defence.

As a general rule a Company of Engineers would be given to every mobilized Infantry Division, but this is not laid down as a hard and fast rule, and more than one Company might be attached, according to circumstances, should it appear desirable. Similarly a Company with mountain equipment would be attached to a Mountain Infantry Division, and a Section similarly equipped to an independent Mountain Brigade.

Of the 15 Army Corps already referred to as existing in peace, the first 13 would, when mobilized for the field, probably comprise each two complete Infantry Divisions of the active Army and a Landwehr (cis-Leithian) or Honved (trans-Leithian) Division. The 14th Army Corps, organized for the defence of the Tyrol and equipped for mountain warfare, would comprise a Division of the active Army and a Tyrolese Reserve Division (*Landesschützen*). The 15th Army Corps and the troops of the Zara Command could not be reckoned on for the Armies in the field, being required for the defence of Bosnia, Herzegovina, and Dalmatia.

According to all probability the number of Divisions mobilized for the field would be 41, and there being 44 Field and Reserve Companies of Engineers,

¹ The service in the Austro-Hungarian Army is 3 years with the Colours, 7 in the Reserve, and 2 in the Landwehr.

² Taken from Tables giving the strength of the Austro-Hungarian Army calculated by the Italian General Staff.

there would only be 3 left for local defence, unless we add the 8 *Dépôt* Companies that could be mobilized, when there would be 11 at the very utmost, and this appears little enough.¹

FIELD EQUIPMENT.

The stores of every kind required for a war footing of those fractions of an Engineer Regiment that would be mobilized at the Regimental Headquarters, are all kept ready there. The stores required for the detached Battalions and detached Reserve Companies are kept where these units would be mobilized, that is to say, at their peace quarters.

The stores are in charge of the *Verwaltungs-Commission* of the Regiment or Battalion, as the case may be. The stores for the Reserve Companies are in charge of the Regimental *Verwaltungs-Commission*.

The various duties connected with the charge and care of the stores required for mobilization, as well as the stores required for training in peacetime, are entrusted to the *Material-Verwaltungs-Commission* of Regiments or Battalions. The Reserve Companies belong to the Regiment in this respect.

The Field Equipment is classed under the following headings:—

- A. The Field Equipment of the Field and Reserve Companies.
- B. " " " " Battalion Staffs and Commanding Engineers of Army Corps.
- C. The Reserve Field Equipment of the Army in the Field, comprising—
 - a. The Intrenching Tool Columns (*Schanzzeug-Kolonnen*).
 - b. The Artillery Reserve Stores, as regards powder and explosives.
 - c. The Engineer Siege Parks (*Belagerungs-Genie-Parks*).
- D. The Reserve Equipment in permanent dépôts, comprising—
 - a. The Chief Engineer Park (*Haupt-Genie-Park*) at Vienna.
 - b. The Engineer Parks for defensive purposes in fortresses (*Vertheidigungs-Genie-Parks*).
 - c. The Intrenching Tool Dépôts (*Schanzzeug-Dépôts*).
 - d. The stores used for training purposes of the Engineer Regiments.
 - e. The Instrument Dépôt belonging to the Technical and Administrative Committee.

A. The Field Equipment of the Field and Reserve Companies.

The Field Equipment of a Field or Reserve Company is so arranged that each Section can work independently. The stores comprised in the equipment of a Section can be carried on the four-horsed Section Equipment wagon (*Genie-Zugs-Requisiten-Wagen*). Besides these there is also with every Company a reserve set of field equipment stores, for replenishing the Section Equipments, carried on a four-horsed Company Equipment wagon (*Genie-Campagnie-Requisiten-Wagen*).

The *Section Equipment* comprises—

1. The Portable Equipment.
2. The Reserve and Mining Equipment.
3. Explosives, fuzes, &c.

The Portable Equipment of a Section is calculated to enable 54 men to be

¹ Until recently there were 40 Field and 16 Reserve Companies available; but on the formation of the Railway and Telegraph Regiment, the latter were reduced to four.

employed at earth works, and 32 men at ordinary timber work, without using the Pioneer sword.

In the field the Portable Equipment would be carried on the march by the men, and the knapsacks carried in the Section Equipment wagon, unless it were certain that no work would have to be undertaken. In peace the Portable Equipment is only carried occasionally for practice at manœuvres, &c.

The Reserve and Mining Equipment, as well as the explosives, &c., are always carried on the march in the Section Equipment wagon.

The Portable Equipment of a section consists of—

- 18 pickaxes,
- 36 shovels,
- 18 felling axes,
- 2 common axes,
- 4 hatchets,
- 2 chain saws,
- 2 hand (frame) saws,
- 2 saw files,
- 1 saw set,
- 4 chisels,
- 5 augers of various sizes,
- 248 nails of various sizes,
- 1 pincers,
- 8 dogs,
- 1 whetstone,
- 6 measuring rules,
- 1 measuring tape,
- 4 carpenters' pencils,
- 2 tracing ropes,
- 18 sets of lashings.

The Mountain Equipment differs only in there being 25 picks and 25 shovels.

The picks, shovels, axes, hatchets, &c., are fitted with straps (*Schanzzeug-Traggurten*), and the axes and hatchets with leather cases as well. The smaller tools, &c., are carried in 6 leather cases (*Werkzeug-Taschen*).

The Section Equipment would comprise, among other stores—

- 16 charges in tin cylinders,
- 22 large cartridges,
- 42 small do.

In all 41·22 kilos. of dynamite and 31·5 kilos. of cannon powder.

The Mountain Equipment would differ in there being—

- 4 charges in tin cylinders,
- 25·22 kilog. of dynamite,

and no powder.

The charges in tin cylinders are of 2 kilog., the large cartridges of 0·19 kilog., and the small cartridge of 0·12 kilog. of dynamite.¹

The total quantity of explosives with a Field Company is 164·88 kilog. of dynamite and 126 kilog. of powder. In the case of the Mountain Equipment it would be 100·88 kilog. of dynamite only.

The Reserve and Mining Equipment consists of a set of carpenter's tools, a set of quarryman's tools, a set of miner's tools, some minor small stores, and a copy of the Equipment Regulations.

The explosives, fuzes, &c., comprise dynamite cartridges of various sizes,

¹ There are also cartridges of 1·12 kilog. of dynamite for Cavalry Pioneers.

fuzes, detonators, quickmatch, and various other small stores used for demolitions.

The *Company Equipment* consists of—

1. An electrical firing apparatus with complete sets of appliances for firing mines, including 700 metres of insulated, and 2,100 metres of plain, copper wire.
2. A field forge complete with hearth, anvil, bellows, &c.
3. A complete set of smith's tools and appliances.
4. A complete set of shoeing smith's tools and appliances, including 16 horse-shoes and 200 nails.
5. Reserve stores of iron, coal, &c.
6. A set of miner's tools and appliances, including 100 metres of insulated wire and 40 electric fuzes.
7. A levelling instrument.
8. A set of surveying instruments with drawing and sketching materials.
9. A set of signalling flags and lanterns, hand books, a company cash box, &c.

B. The Field Equipment of a Battalion Staff and an Army Corps Commanding Engineer.

This comprises surveying, drawing, and office instruments and appliances for making surveys and projects in the field, and in the case of the Battalion Staff, a battalion cash box, and in the case of an Army Corps Commanding Engineer, the Field Records as well. In either case the equipment is carried in a two-horse covered wagon (*Deckel-Wagen*).

C. The Reserve Field Equipment of the Army in the Field.

a. There would be fifteen *Intrenching Tool Columns* belonging to the 1st Line of the Army in the Field. *Intrenching Tool Columns* attached to an Army Corps would, for the time being, belong to the 1st Section of the Train Squadron of that Army Corps, and would be under the Officer Commanding it in matters of discipline and rations for man and horse. In technical matters the Columns would be under the Army Corps Commanding Engineers. *Intrenching Tool Columns* belonging to an Army, and united in one command, would form the *Intrenching Tool Park* (*Schanzzeug-Park*) of that Army, and would generally be placed under an Engineer Officer selected for the purpose. It would march with the Army Ammunition Parks.

Intrenching Tool Columns would be used for throwing up field works on a large scale in the field, commencing early siege operations against a fortress, or replenishing the stores with the troops, rendered unserviceable or lost.

The stores of an *Intrenching Tool Column* are classed as—

1. Tools and appliances.
2. Explosives, fuzes, &c.
3. Surveying and drawing instruments, &c.

All these stores are carried on 7 four-horsed covered wagons. The tools and appliances are calculated for 1,150 men at earth work, 170 men at timber work, 5 parties of quarrymen, and 4 parties of miners.

The stores of the *Intrenching Tool Columns*, including the Train stores, are in charge of the Engineers.

Each *Intrenching Tool Column* would consist of 1 sergeant-major, 1 corporal, 6 lance-corporals and sappers (including 1 smith), 14 drivers, 28 draught horses, and 7 four-horse wagons (*Deckel-Wagen*).

The 1st Regiment of Engineers would form 5 Columns and 1 Army Park Staff; the 2nd Regiment would form 10 Columns and 2 Army Park Staffs.

b. The Artillery Reserve Stores would supply the Engineers and Pioneers, the Railway and Telegraph Regiment, the Intrenching Tool Columns, and the Cavalry Pioneers, with explosives, fuzes, &c., carried in special two-horsed wagons (*Sprenghmittel-Wagen*).

There would be one of these to every Army Corps Ammunition Park in the Artillery Reserve Stores of the 1st Line, and one to every Army Ammunition Park in the Artillery Reserve Stores of the 2nd Line, and there would be 10 such wagons with the Army Ammunition Reserve Parks and Army Ammunition Field Depôts respectively.

These wagons are always in charge of a trained non-commissioned officer of Engineers.

The explosives comprise powder in bags and dynamite in cartridges.

c. There are two Engineer Siege Parks that would be mobilized in war. In peace they form part of the Engineer Chief Park and would be mobilized and equipped by it. An Engineer Siege Park in war would be under a Captain of Engineers with a detachment of non-commissioned officer and men of Engineers. The size of an Engineer Siege Park would vary according to circumstances, and no fixed establishment is laid down.

D. Reserve Equipment in Permanent Depôts.

a. The Chief Engineer Park at Vienna is the main depôt from which all Engineer Stores, either for attack or defence, would be forthcoming in case of war. It comprises the two Siege Parks just referred to and a reserve of every kind of Engineer *matériel*. It belongs to the 2nd Regiment of Engineers, and supplies the fractions of this Regiment in peace with certain stores for training and other purposes. It also supplies stores to the Engineer Parks for defensive purposes in Fortresses and the Intrenching Tool Depôts. It is under a Captain on the retired list (*Ruhestand*) who is also a member of the *Material-Verwaltungs-Commission* by which the business of the Park is managed. He is assisted by a subaltern Officer and fourteen men of the 2nd Regiment of Engineers.

b. The Engineer Parks for defensive purposes in Fortresses comprise a certain amount of stores and *matériel* that would be necessary in case of a siege. The Engineers that are quartered in these fortresses draw the stores they require for training purposes from these Parks.

c. There are four Intrenching Tool Depôts at Krakau, Brod, Ragusa, and Enns, where a certain amount of Engineer stores are kept in case of war. The stores are chiefly obtained from the Chief Park at Vienna.

d. The Stores used for training purposes of the Engineer Regiments would, when the various detachments of these Regiments took the field with their field equipment, be handed over to the Chief Engineer Park or Engineer Parks for defensive purposes in Fortresses, except such stores as were necessary for the training of the Depôt Companies.

e. The Instrument Depôt, comprising surveying instruments, electrical firing apparatus, &c., is in charge of the Technical and Administrative Military Committee by which the various branches of the Engineer Service would be supplied with articles of the kind.

Rations and Forage.

The regulations as regards rations in the field are the same for the Engineers as for the other dismounted branches.

As a rule the soldier carries 2 days' ordinary rations (*Currenten-Verpflegs-Vorrath*) in the field with the exception of fresh meat, but under certain

circumstances, 3 or even 4 days' rations. The dismounted Officers' rations are carried by their servants.

The ordinary rations for 2 days consist of: two rations of bread or biscuit, vegetables, preserved soup, salt, pepper, coffee or tea, rum, and tobacco.

One day's fresh meat is carried in the meat wagons.

Corps, Regiments, and Army Corps and Divisional Staffs have their own butcheries, and detachments that have not would draw their meat from these, and only under exceptional circumstances form a Slaughter Depôt (*Schlacht-Vieh-Depôt*). An Engineer Battalion on a full war strength united would be allowed seven live oxen for 4 days' consumption.

Two days' forage (oats and hay), and under exceptional circumstances, even 3 or 4 days' forage, is carried in the wagons.

One day's reserve rations (*Reserve-Verpflegs-Vorrath*) is, besides the above, carried by the dismounted soldier in the pack. It consists of one ration of biscuit (500 grammes), one of preserved meat, one of preserved soup, two rations of salt, and one ration of tobacco. One-third of a hay ration is also carried for each horse.

Train.

The wagons, horses, drivers, &c., of the various Engineer formations in the field are given in the Tables.

There are two kinds of wagons used, viz., the *Deckel-Wagen* of the 1867-80 pattern used for carrying Engineer tools and stores, and the *Rüst-Wagen* or *Proviant-Wagen* used for carrying rations, forage, &c.

The former is a covered wagon, and the latter a wagon with open rail sides (*Leiter-Wagen*).

It has already been seen that a Field Company has 5 four-horsed wagons (*Deckel-Wagen*) for tools and appliances, and 1 four-horsed wagon (*Leiter-Wagen*) for forage, provisions, &c.

A Battalion Staff has a two-horsed *Deckel-Wagen*, but if a Battalion or a Half Battalion were kept together, it would have in addition a two-horsed meat wagon, and in the former case a two-horsed canteen wagon (*Marketender-Wagen*) as well.

In the mountain equipment, pack animals would be used either instead of, or with wheeled transport.

Deckel-Wagen for the commanding Engineers of 3 Army Corps are in charge of the 1st Regiment, one being with the Depôt Battalion Cadre (10th Army Corps), one with the 2nd Depôt Company Cadre (11th Army Corps), and one with the 4th Depôt Company Cadre (9th Army Corps).

Deckel-Wagen for 8 Commanding Engineers of Army Corps are in charge of the 2nd Regiment, 2 being with the 2nd Depôt Company Cadre (5th and 14th Army Corps), 5 with the 4th Depôt Company Cadre (6th, 7th, 12th, 13th, and 15th Army Corps), and one with the 1st Reserve Company at Gratz (3rd Army Corps).

TABLE I.—*Peace Strength of a Field and a Reserve Company.*

| | | A Field Company. | A Reserve Company. | | |
|-----------------------------------|---|--------------------------|--------------------------------------|----|----|
| Officers | { | Captains | 1 | 1 | |
| | | Subalterns | 4 | 1 | |
| Non-commissioned officers and men | { | with carbines | Sergeant-major | 2 | 1 |
| | | | Sergeant (<i>Zugsführer</i>) | 4 | 2 |
| | | | Corporals | 8 | 3 |
| | | | Lance-corporals | 8 | 3 |
| | | | 1st class sappers | 34 | 20 |
| | { | without carbines | 2nd " " | 48 | 28 |
| | | | Non-com. officer paymaster | 1 | 1 |
| | | | Bugler (1st class sapper) | 1 | — |
| | | Officers' servants | 5 | 2 | |
| Total | | 116 | 62 | | |

Remarks.—(A) Should the company be short of a subaltern Officer, there would be an additional sergeant-major and one Officer's servant less.

(B) In a Reserve Company, a sapper would act as bugler.

TABLE III.—*War Establishment of a Field (or Reserve) and Depot Company and Intrenching Tool Column.*

| | | Field or Reserve Company. | Depôt Company. | Intrenching Tool Column. |
|------------------------------------|--------------------|---------------------------------|----------------|--------------------------|
| Officers | { Captains | 1 | 1 | — |
| | { Subalterns..... | 4 | 4 | — |
| Non-commissioned officers and men. | { with carbines | { Sergeant-majors | 3 | 1 |
| | | { Sergeants | 8 | — |
| | | { Corporals | 16 | 1 |
| | | { Lance-corporals..... | 24 | 2 |
| | | { 1st and 2nd class sappers... | 160 | 4 |
| | { without carbines | { Cadet Acting-Officer | 1 | — |
| | | { Non-com. officer paymaster .. | 1 | — |
| | | { Buglers | 2 | — |
| | | { Drivers | 15 | 14 |
| | | { Officers' servants | 5 | — |
| Total | | 240 | 235 | 22 |

Horses.

| | | | | |
|-------------|--|----|----|----|
| Draught | { For a company tool, &c., wagon | 4 | — | — |
| | { For 4 section ditto | 16 | — | — |
| | { For a provision, &c., wagon | 4 | — | — |
| | { For 7 tool, &c., wagons | .. | .. | 28 |
| Riding.... | { Spare horses | 2 | — | — |
| | { For reconnoitring purposes | 2 | — | — |
| Total | | 28 | — | 28 |

NOTES.

a. Should there be an Officer or a Cadet-Acting-Officer short, there would be an additional sergeant-major.

b. In a Field or a Reserve Company, a sergeant would be told off as baggage master (*Wagen-Meister*).

c. In war 2nd class sappers can be promoted to 1st class to the extent of two-thirds of the total establishment. The number in a Depot Company may vary, but there should be at least 20 1st class sappers. The total number in a Depot Company may, under certain circumstances, be raised to 300; but when the number exceeds 170, there would be added, for every additional 15 men, a corporal and a lance-corporal, for every additional 30 men a sergeant, and if the excess is more than 100, a Lieutenant, a sergeant-major, and an Officer's servant.

d. In a detached Depot Company there would be a Surgeon or Assistant-Surgeon in addition, with a staff clerk and an Officer's servant.

e. There should be a shoeing smith in the establishment of an Intrenching Tool Column.

TABLE V.—*Showing Non-commissioned Officers and Men on Command in Various Employments.*

| From the 1st Regiment of Engineers. | With carbines. | | Without carbines. | | Total. |
|---|---|-----------------------------|---|-----------------------------|--------|
| | Sergeant-majors, sergeants, or corporals. | Lance-corporals or sappers. | Sergeant-majors, sergeants, or corporals. | Lance-corporals or sappers. | |
| The War Ministry | .. | .. | 2 | .. | 2 |
| The Office of the Inspector-General..... | .. | .. | 2 | 2 | 4 |
| The Engineer Direction at Trieste | 1 | 2 | .. | .. | 3 |
| " " Pola | 2 | 18 | .. | .. | 20 |
| " " Prague | 1 | 2 | .. | .. | 3 |
| " " Budweiss | 1 | 2 | .. | .. | 3 |
| " " Josephstadt... | 1 | 6 | .. | .. | 7 |
| " " Theresienstadt | 1 | 4 | .. | .. | 5 |
| " " Brünn | 1 | 2 | .. | .. | 3 |
| " " Olmütz..... | 1 | 4 | .. | .. | 5 |
| " " Lemberg..... | 1 | 2 | .. | .. | 3 |
| " " Czernowitz ... | 1 | 2 | .. | .. | 3 |
| " " Cracow..... | 1 | 4 | .. | .. | 5 |
| " " Przemysl | 1 | 6 | .. | .. | 7 |
| " " Zara | 1 | 2 | .. | .. | 3 |
| " " Ragusa | 1 | 6 | .. | .. | 7 |
| " " Cattaro..... | 1 | 14 | .. | .. | 15 |
| The Artillery Store Depot at Wiener Neustadt..... | .. | .. | 1 | .. | 1 |
| Total | 16 | 76 | 5 | 2 | 99 |

| Subalterns. | Sergeant-majors. | Sergeants. | Cavalry |
|-------------|------------------|------------|---------|
| 6 | 8 | 16 | 3 |
| 6 | 8 | 16 | 3 |
| 6 | 8 | 16 | 3 |
| 6 | 8 | 16 | 3 |
| 6 | 8 | 16 | 3 |
| 9 | 27 | 10 | |

Wi

| | | | | Colonel Commanding the Regt. | Lieut.-Colonels or Majors Com- manding Battalions. | Regimental Adjutants. | Quartermasters. | Battalion Adjutants. | Public | |
|----------------------------------|---------------------------------------|--|--|------------------------------|---|-----------------------|-----------------|----------------------|--------|--|
| Regimental Staff | | | | 1 | .. | 1 | .. | .. | .. | |
| 1st Field Battalion | | | | .. | 1 | .. | 1 | 1 | .. | |
| 2nd ,, | | | | .. | 1 | .. | 1 | 1 | .. | |
| 3rd ,, | | | | .. | 1 | .. | .. | 1 | .. | |
| 4th ,, | | | | .. | 1 | .. | .. | 1 | .. | |
| 5th ,, | | | | .. | 1 | .. | 1 | 1 | .. | |
| 2nd Reserve Companies | | | | .. | .. | .. | .. | .. | .. | |
| Depôt Battalion | Staff and 1st and 3rd Depôt Companies | | | .. | 1 | .. | .. | 1 | .. | |
| | 2nd Depôt Company..... | | | .. | .. | .. | .. | .. | .. | |
| | 4th ,, | | | .. | .. | .. | .. | .. | .. | |
| | 5th ,, | | | .. | .. | .. | .. | .. | .. | |
| Six Intrenching Tool Columns ... | | | | .. | .. | .. | .. | .. | 4 | |

TABLE II.—*Peace Establishment of the 1st Regiment of Engineers.*

| | Staff. | | | | | | | | | | | | | | | Companies. | | | | | | | | | | | | Total. | Grand total. | | | Total combatants. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|------------------------------|--|---------------------|----|-----------------|---|-----------|------------------------------|--------------------|------------------|------------|--------------------------------------|------------------|---------------------|---------|------------|---------|--------|---------|--------|-----------|-------------|----------------|---|---|----|----|--------|-------------------|----|---|-------------------|---|-----------|------------------------------------|----------------------------|-----------|------------------------------------|---------|-----------|------------------------------------|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|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| | Colonel Commanding the Regt. | Lieutenant-Colonels or Majors commanding Battalions. | Subaltern Officers. | | Quartermasters. | Captain or Lieutenant-Colonel Judge-Advocate. | Surgeons. | Captain or First Lieutenant. | Second Lieutenant. | Corporal clerks. | Armourers. | Non-commissioned officer paymasters. | Staff-sergeants. | Officers' servants. | Horses. | Total. | Horses. | Total. | Horses. | Total. | Officers. | Subalterns. | With carbines. | | | | | | Without carbines. | | | | | Officers. | Non-commissioned officers and men. | Horses (private property). | Officers. | Non-commissioned officers and men. | Horses. | Officers. | Non-commissioned officers and men. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Regimental Staff | 1 | .. | 1 | .. | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | .. | .. | .. | .. | .. | 1 | 5 | 1 | | | | | | | | | 3 | 5 | 6 | 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |

NOTE.

- (a.) Of the Captains, two-thirds would be First Class Captains and one-third Second Class Captains.
- (b.) Forty-seven of the subalterns would be First Lieutenants, and forty-six Second Lieutenants.
- (c.) Half the non-commissioned officer paymasters would be of the rank of sergeant-major, and the remainder of the rank of sergeant (1st and 2nd class non-commissioned officer paymasters).
- (d.) The Peace Establishment of the 2nd Regiment differs only from the above in having ninety-eight non-commissioned officers and men on command, as shown in Table V, instead of ninety-nine.

TABLE IV.—*War Establishment of the 1st Regiment of Engineers.*

[illegible]

* 1 Paymaster-sergeant, 5 sergeant-majors, sergeants, or corporals, and 2 lance-corporals or sappers.

NOTES.

- (a.) Two-thirds of the Captains would be First Class Captains, and one-third Second Class Captains. The subalterns would be First and Second Lieutenants in equal numbers.
 (b.) Of the non-commissioned officer paymasters, 15 would be of the rank of sergeant-major and 14 of the rank of sergeant.
 (c.) The staff-clerk would act as Baggage-master.
 (d.) The establishment of sappers in the Depot Companies may vary (see Table III, note c).
 (e.) Two-thirds of the sappers may be 1st class sappers.
 (f.) The higher establishment of the Staffs of the 1st, 2nd, and 5th Field Battalions are made under the supposition that the Companies of these Battalions are kept together.
 (g.) The establishment of the 2nd Regiment is the same, except that there would be 10 Intrenching Tool Columns, with a total establishment of 11 Officers, 594 non-commissioned officers and men, and 985 horses, or 157 Officers and 6,028 non-commissioned officers and men, combatants.

| | | | | | | | Grand total | | | Total combatants. | |
|-----------|-------------------|----------|----------------|-----------|------------------------------------|---------|-------------|------------------------------------|---------|-------------------|------------------------------------|
| l men. | | | | | | | | | | | |
| Horses. | | | | Total. | | | | | | | |
| Liding. | | | | | | | | | | | |
| property. | Private property. | Draught. | Spare draught. | Officers. | Non-commissioned officers and men. | Horses. | Officers. | Non-commissioned officers and men. | Horses. | Officers. | Non-commissioned officers and men. |
| . | .. | .. | .. | .. | .. | .. | 2 | 4 | 5 | 2 | — |
| 8 | 2 | 96 | 8 | 20 | 940 | 114 | 25 | 955 | 125 | 22 | 856 |
| 8 | 2 | 96 | 8 | 20 | 940 | 114 | 25 | 955 | 125 | 22 | 856 |
| 8 | 2 | 96 | 8 | 20 | 940 | 114 | 22 | 944 | 120 | 22 | 856 |
| 8 | 2 | 96 | 8 | 20 | 940 | 114 | 22 | 944 | 120 | 22 | 856 |
| 8 | 2 | 48 | 8 | 20 | 940 | 114 | 25 | 955 | 125 | 22 | 856 |
| 4 | .. | 48 | 4 | 10 | 470 | 56 | 10 | 470 | 56 | 10 | 428 |
| . | .. | .. | .. | 10 | 460 | .. | 15 | 471 | 3 | 12 | 428 |
| . | .. | .. | .. | 5 | 230 | .. | 5 | 231 | .. | 5 | 224 |
| . | .. | .. | .. | 5 | 230 | .. | 5 | 231 | .. | 5 | 224 |
| . | .. | .. | .. | 5 | 230 | .. | 5 | 231 | .. | 5 | 224 |
| 4 | .. | 146 | .. | 4 | 424 | 150 | 4 | 424 | 150 | 3 | 200 |

TABLE VII.—*Train*

| | | Drivers. | Deckel. | |
|---------------|--------------------------------|--------------------------|---------|----|
| | | | Two- | |
| 1st Regiment. | Regimental Staff | 2 | .. | |
| | 5 Field Battalions { | 5 Battalion Staffs..... | 10 | 5 |
| | | 20 Field Companies | 300 | .. |
| | 2 Reserve Companies | 30 | .. | |
| | The Depôt Battalion Staff..... | 1 | .. | |
| | According to Table V..... | 73 | 3 | |
| | Total..... | 416 | 4 | |
| 2nd Regiment. | Regimental Staff..... | 2 | .. | |
| | 5 Field Battalions { | 5 Battalion Staffs | 10 | 5 |
| | | 20 Field Companies | 300 | .. |
| | 2 Reserve Companies | 30 | .. | |
| | The Depôt Battalion Staff..... | 1 | .. | |
| | According to Table V | 148 | 8 | |
| | Total..... | 491 | 8 | |

(a.) In addition to the above, a Battalion or Half-Battalion

(b.) The Quartermaster of a united Battalion would be allc

(c.) A united Battalion would have a canteen man, who wo

(d.) Of the drivers, 2 would be detailed as bātmen to the C
Field or Depôt Battalion.

(e.) A driver is reckoned for every 2 draught or riding hors

TABLE VI.—*War Establishment of Detachments furnished by the Engineer Regiment.*

| | Officers. | | Non-commissioned officers and men. | | | | | | | | | | Horses. | | Total. | | | Covered wagons. | | |
|--|---------------------|-------------|------------------------------------|------------|------------|------------------------------|----------------|------------------|------------|------------|------------------------------|----------|---------------------|-------------------------|----------|-----------|------------------------------------|-----------------|-------------|--------------|
| | Captains. | Subalterns. | Sergeant-majors. | Sergeants. | Corporals. | Lance-corporals and sappers. | Pay-sergeants. | Sergeant-majors. | Sergeants. | Corporals. | Lance-corporals and sappers. | Drivers. | Officers' servants. | Riding public property. | Draught. | Officers. | Non-commissioned officers and men. | Horses. | Two-horsed. | Four-horsed. |
| 5 Intrenching Tool Columns | .. | .. | 5 | .. | 5 | 30 | .. | .. | .. | .. | .. | 70 | .. | .. | 140 | .. | 110 | 140 | .. | 35 |
| 1 Army Intrenching Tool Park Staff.. | 1 | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | 1 | .. | 1 | 2 | 1 | — | — |
| On command, as shown in Table V | .. | .. | 16 | | | 76 | .. | 5 | | | 2 | .. | .. | .. | .. | .. | 99 | — | — | — |
| For 3 Commanding Engineers of Army Corps as Adjutants | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 3 | 3 | 6 | 3 | 6 | 9 | 3 | — |
| For the wagons carrying explosives with the Artillery Reserve Estab- lishments | Depôt Battalion.... | | .. | .. | .. | 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | — | — | — |
| | 2nd Depôt Company | | .. | .. | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | — | — | — |
| | 4th „ „ | | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | — | — | — |
| In various other capacities | .. | .. | 100 | | | 190 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 200 | — | — | — |
| Total..... | 1 | 3 | 133 | | | 206 | 1 | .. | 5 | .. | 2 | 73 | 4 | 4 | 146 | 4 | 424 | 150 | 3 | 35 |
| 10 Intrenching Tool Columns | .. | .. | 10 | .. | 10 | 60 | .. | .. | .. | .. | .. | 140 | .. | .. | 280 | .. | 220 | 280 | .. | 70 |
| 2 Army Intrenching Tool Park Staffs..... | 2 | .. | .. | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 2 | 2 | .. | 2 | 4 | 2 | — | — |
| On command as shown in Table V | .. | .. | 22 | | | 74 | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | 98 | — | — | — |
| For 8 Commanding Engineers of Army Corps as Adjutants. | .. | 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 8 | 8 | 8 | 16 | 8 | 16 | 24 | 8 | — |
| For the wagons carrying explosives with the Artillery Reserve Estab- lishments | Depôt Battalion.... | | .. | .. | 2 | 28 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 30 | — | — | — |
| | 2nd Depôt Company | | .. | .. | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | — | — | — |
| | 4th „ „ | | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5 | — | — | — |
| | 1st Reserve „ | | .. | .. | .. | 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | — | — | — |
| For the Engineer Chief Park..... | .. | 1 | 3 | | | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 14 | — | — | — |
| In various other capacities | .. | .. | 100 | | | 100 | .. | .. | | | .. | 1 | .. | .. | .. | .. | 200 | — | — | — |
| Total..... | 2 | 9 | 187 | | | 244 | 2 | 2 | | | .. | 148 | 11 | 10 | 296 | 11 | 594 | 306 | 8 | 70 |

NOTE.—Intrenching Tool Columns Nos. 2, 5, and 14 are formed by the 2nd Depôt Company Cadre } of the 1st Regiment.
 „ „ „ 4, 6, 7, 12, 13, and 15 „ 4th „ „ „ }
 „ „ „ 3 by the 1st Reserve Company..... }
 „ „ „ 10 by the Depôt Battalion Cadre..... }
 „ „ „ 1 and 11 by the 2nd Depôt Company Cadre } of the 2nd Regiment.
 „ „ „ 8 and 9 by the 4th „ „ „ }
 The Army Intrenching Tool Park Staffs would be formed at Vienna, Prague, and Buda-Pesth.

TABLE VII.—*Train of the Engineer Regiment.*

| | | Drivers. | Wagons. | | | | | Total. | Horses. | | | | |
|--|--|----------|---------|---------|-------------------------------|-------------------------|-------------------------|--------|-------------------|-------|----------|----------------|--------|
| | | | Deckel. | Wagons. | Proviant or Riflet-wagons. | Company tool wagons. | Section tool wagons. | | Riding. | | Draught. | Spare draught. | Total. |
| | | | | | | | | | Two- | Four- | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | Horsed. | | | | | Public property. | | Private property. | | | | |
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of the Engineer Regiment.

| | | Wagons. | | | | Horses. | | | | | |
|-----------|---------|---------|-----------------------------|-------------------------|-------------------------|---------|------------------|-------------------|----------|----------------|--------|
| men. | H | Wagons. | Proviant or Rüst-wagons. | Company tool wagons. | Section tool wagons. | Total. | Riding. | | Draught. | Spare draught. | Total. |
| | | | | | | | Public property. | Private property. | | | |
| property. | Private | Four- |  |  |  |  |  |  |  |  |  | Horsed. |
| riding. | | | | | | | | | | | |
| 8 | | .. | .. | .. | .. | .. | 1 | 4 | .. | .. | 5 |
| 8 | | .. | .. | .. | .. | 5 | 8 | 15 | 10 | .. | 33 |
| 8 | | .. | 20 | 20 | 80 | 120 | 40 | 10 | 480 | 40 | 570 |
| 8 | | .. | 2 | 2 | 8 | 12 | 4 | .. | 48 | 4 | 56 |
| 8 | | .. | .. | .. | .. | .. | 1 | 2 | .. | .. | 3 |
| 8 | | 35 | .. | .. | .. | 38 | 4 | .. | 146 | .. | 150 |
| 8 | 3 | 22 | 22 | 88 | 175 | 58 | 31 | 684 | 44 | 817 | |
| 8 | | .. | .. | .. | .. | .. | 1 | 4 | .. | .. | 5 |
| 8 | | .. | .. | .. | .. | 5 | 8 | 15 | 10 | .. | 33 |
| 4 | | .. | 20 | 20 | 80 | 120 | 40 | 10 | 480 | 40 | 570 |
| 4 | | .. | 2 | 2 | 8 | 12 | 4 | .. | 48 | 4 | 56 |
| 4 | | .. | .. | .. | .. | .. | 1 | 2 | .. | .. | 3 |
| 4 | 70 | .. | .. | .. | 78 | 10 | .. | 296 | .. | 306 | |
| 4 | 3 | 22 | 22 | 88 | 215 | 64 | 31 | 834 | 44 | 973 | |

NOTES.

kept together, would have a country wagon for carrying meat.
 would a riding horse, the property of the public.
 would be obliged to bring his own wagon.
 Colonel Commanding the Regiment, and 1 man to the Officer Commanding a
 es, and for every spare horse.

9 non-com. officers and 33 men are furnished by the 1st and 3rd Field Battalions.

4 " 14 " " 2nd Field Battalion.

4 " 14 " " 4th "

4 " 17 " " 5th "

Besides the above, the Reserve Engineer Companies at Theresienstadt furnish the Engineer Direction in that place with 2 men borne on the establishment, and similarly 1 non-commissioned officer and 12 men are furnished to the Engineer Direction at Olmütz, and the same number to the Engineer Direction at Cracow, by the Engineer troops quartered in those places. These are relieved every month.

TABLE V—(continued).

| From the 2nd Regiment of Engineers. | With carbines. | | Without carbines. | | Total. |
|--|---|-------------------------------|---|-------------------------------|--------|
| | Sergeant-majors, sergeants, or corporals. | Lance - corporals or sappers. | Sergeant-majors, sergeants, or corporals. | Lance - corporals or sappers. | |
| The War Ministry | .. | .. | 1 | .. | 1 |
| The Engineer Direction at Vienna | 1 | 4 | .. | .. | 5 |
| " " Linz | 1 | 2 | .. | .. | 3 |
| " " Gratz | 1 | 2 | .. | .. | 3 |
| " " Malborgeth (Klagenfurt) | 1 | 2 | .. | .. | 3 |
| " " Buda-Pesth .. | 1 | 2 | .. | .. | 3 |
| " " Fünfkirchen .. | 1 | 2 | .. | .. | 3 |
| " " Pressburg | 1 | 2 | .. | .. | 3 |
| " " Komorn | 2 | 18 | .. | .. | 20 |
| " " Kashau | 1 | 2 | .. | .. | 3 |
| " " Miskolcz | 1 | 2 | .. | .. | 3 |
| " " Temesvar | 1 | 4 | .. | .. | 5 |
| " " Arad | 1 | 3 | .. | .. | 4 |
| " " Hermannstadt | 1 | 2 | .. | .. | 3 |
| " " Karlsburg | 1 | 3 | .. | .. | 4 |
| " " Agram | 1 | 2 | .. | .. | 3 |
| " " Essegg | 1 | 6 | .. | .. | 7 |
| " " Peterwardein. | 1 | 6 | .. | .. | 7 |
| " " Innsbruck ... | 1 | 2 | .. | .. | 3 |
| " " Brixen - Fran- zensfeste ... | 1 | 2 | .. | .. | 3 |
| " " Trent | 2 | 6 | .. | .. | 8 |
| The Engineer Chief Park at Vienna | .. | .. | 1 | .. | 1 |
| Total | 22 | 74 | 2 | .. | 98 |

10 non-com. officers and 30 men are furnished by the 1st and 3rd Field Battalions.

5 " 14 " " 2nd Field Battalion.

4 " 15 " " 4th "

5 " 14 " " 5th "

PART II.—THE PIONEERS.

THE PIONEER REGIMENT (DAS PIONNIER-REGIMENT).

Peace Organization.

The Pioneers are organized in a single Regiment. It consists in peace of a Regimental Staff, and 5 Field Battalions of 4 Field Companies, a Reserve Company, a Dépôt Company, and a Store Reserve (*Zeugs-Reserve*) each. In peace the Dépôt Companies exist in Cadre only. The Field Battalions are numbered 1 to 5, and the Field Companies 1 to 20. The Reserve Companies, Dépôt Companies, and Store Reserves bear the numbers of their respective Field Battalions.

The Regiment also includes a Pioneer Store Dépôt which, on mobilization, would form 2 Field Store Dépôts.

The Regimental Staff consists of a Colonel in Command, 2 Captains, an Adjutant (subaltern), 2 Paymasters, a Surgeon, 4 non-commissioned officers, and 7 servants.

A Battalion Staff consists of a Field Officer in Command, an Adjutant (subaltern), a Paymaster, a Surgeon, 2 non-commissioned officers, and 4 servants.

A Field Company consists of 4 Officers, 16 non-commissioned officers, and 101 lance-corporals and men. A Reserve Company consists of 1 Officer, 8 non-commissioned officers, and 12 lance-corporals and men. A Dépôt Company Cadre consists of 2 Officers, 3 non-commissioned officers, and 4 men; and a Store Reserve of 1 Officer, 2 non-commissioned officers, and 4 men.

The total peace establishment of a Battalion is 24 Officers and 507 non-commissioned officers and men, and of the Regiment is 127 Officers and 2,546 non-commissioned officers and men.

Details of the establishment are given in Tables I and II.

Officers.

The Officers of the Pioneer Regiment form a special service by themselves, and are shown in the Army List as either doing duty with the Regiment or employed in various ways, but none are employed in the Engineer Directions, that is to say, technically as Engineer Officers.

The Army List of 1885 gives the number of Officers belonging to the Regiment as 2 Colonels, 4 Lieutenant-Colonels, 7 Majors, 27 First Class Captains, 12 Second Class Captains, 58 First Lieutenants, 63 Second Lieutenants, and 33 Cadets. Of the latter 20 are Acting-Officers.

Of these, 4 First Lieutenants, 29 Second Lieutenants, and 1 Cadet are Reserve Officers.

One Colonel, 2 Lieutenant-Colonels, 3 Majors, 23 First Class Captains, 10 Second Class Captains, 43 First Lieutenants, 34 Second Lieutenants, and 32 Cadets are actually shown as doing duty with the Regiment. The remainder are attached to the General Staff (3 Captains), the Railway and Telegraph Regiment, and the Technical Committee at the War Ministry, or employed as instructors at the Pioneer Cadet School at Hainburg, the Technical Military Academy, &c.

Pioneer Officers nearly all come from the Pioneer Cadet School at Hainburg near Vienna, though some get commissions from the Technical Military Academy at Vienna.

The Cadet School at Hainburg has an establishment of 140 students. The admission of candidates takes place annually in September in batches of

about forty. Candidates must have passed the fifth class in *Civil-Real-Schulen* or *Gymnasien-Schulen*; the course is nominally three years.

The Regulations for appointment and promotion are the same as in the Infantry, Rifles, and Cavalry. Up to the rank of First Lieutenant inclusive, the Officers of the Pioneer Regiment form their own *Concretual-Stand*, or lists for promotion either by seniority or selection, but above this rank they are borne on the general lists of the Infantry and Rifles (see under Engineer Officers, p. 801).

Pioneer Officers do not attend the Advanced Engineer Class, but the Field Officers' Class (*Stabs Officers' Curs*)—an institution for the Infantry, Rifles, and Cavalry to enable Officers to qualify for promotion—and the same rules apply to them as to the Officers of these Arms.

The Colonel in peace commands the Regiment in every detail, and his duties and responsibilities are laid down in the "*Dienst Reglement für das K.K. Heer*" and other Special Regulations. Certain powers are, however, delegated to the Officers Commanding detached Battalions, and these are precisely the same as in the case of the Engineer Regiments, to which allusion has already been made.

A Battalion is commanded by a Lieutenant-Colonel or a Major, and his duties as regards military, administrative, and training matters, are much the same as those described in the case of the Officers Commanding Engineer Battalions.

A Field or Dépôt Company, a Store Reserve, or a Pioneer Store Dépôt is commanded by a Captain, but a Reserve Company by a subaltern.

There is an Adjutant to the Regiment and an Adjutant to each Field Battalion—all subalterns.

The Officers' uniform is the same colour as those of the men, with the exception of the forage cap, which is of the Infantry pattern. The pattern of the uniform is that known in Austria as the German Infantry, and the distinctions of rank and other details are as in the Infantry or Rifles.

For duties and responsibilities of Pioneer Officers when acting with Engineer Officers (see under Engineer Officers, p. 805).

Peace Quarters and Recruiting.

The stations of the Regiment are chosen with a view to facilitate recruiting and training, and may be considered as permanently fixed. The Battalions are always kept together unless under very exceptional circumstances.

The present stations of the Regiment are :—

| | | |
|---|---|-----------|
| Headquarters and the 5th Battalion at Klosterneuburg. | | |
| 1st Battalion..... | „ | Presburg. |
| 2nd „ | „ | Linz. |
| 3rd „ | „ | Prague. |
| 4th „ | „ | Pettau. |

The Pioneer Store Dépôt is at Klosterneuburg, with a detachment at Sharnstein (Upper Austria) commanded by an Officer.

Like the Engineers, the Pioneer Battalions are each recruited from certain districts.

The 1st Battalion at Presburg draws its recruits from Hungary, the 2nd Battalion at Linz from Upper and Lower Austria and Salzburg, the 3rd Battalion at Prague from Bohemia, the 4th Battalion at Pettau from Hungary, Croatia, and Slavonia, and the 5th Battalion at Klosterneuburg from Upper and Lower Austria, Salzburg, Moravia, Silesia, Styria, Carinthia, Carniola, Istria, Goritz, Gradiska, and Trieste.

The annual recruit contingent for the Pioneer Regiment is about 880 men.

As in the Engineers, drivers and bätmen are provided for mobilization by the transfer, by direction of the War Ministry, of Reserve men of the Cavalry.

The following are the rules observed in selecting men as recruits for the Pioneers.

The minimum standard is 1.68 metres (5 feet 6 inches) and the man must be sturdily built, and able to read and write, or at any rate intelligent enough to be easily taught. Care is taken that recruits are sound as regards hearing. Men that have passed the *Real-Schulen* or tradesmen may be taken at a standard as low as 1.58 (5 feet 2 inches) and sailors and boatmen, if they are strong and muscular, at the *minimum* standard fixed for the Army, or 1.554 metres (5 feet 1 inch).

The trades of recruits that are most desirable are sailors, boatmen, shipwrights, boatbuilders, fishermen, and raftsmen, and 45 per cent. of the contingent should consist of men of these callings; 15 per cent. should consist of carpenters, and the remainder of joiners, wheelwrights, packers, wood cutters, blacksmiths, locksmiths, tinsmiths, fitters, file cutters, navvies, masons, bricklayers, rope-makers, painters, and collar-makers, with the usual proportion of tailors and shoemakers.

The annual recruit contingent joins nominally on the 1st October. The distribution of the recruits to the Field Companies is left to the Colonel Commanding the Regiment, the various trades being always kept in the same proportion. Casualties in the Depôt Company Cadres and in the Store Reserves are at once filled up, but in other fractions of the Regiment twice a year—in the autumn and spring.

The number of men serving beyond their compulsory time and re-engaging annually, from Cadet-Acting-Officer downwards, must not exceed 300 in the Regiment altogether.

The requirements in drivers and bätmen are annually filled up in the autumn at the furlough season, by the transfer of Reserve men from the Cavalry, by order of the War Ministry.

The Colonel has to see that the whole requirement in the non-commissioned ranks for the Regiment on a war footing is forthcoming in the Reserve with a surplus of 6 per cent.

The total roll (*Grundbuchsstand*) of all parts of the Regiment is readjusted every year at the furlough season, so that in case of mobilization the increase in the various fractions would be evenly distributed. The total roll of the Field Companies must show besides their fixed war establishment, an excess of men equal to the annual recruit contingent. The total roll of the Reserve Companies, Store Reserves, and Pioneer Store Depôt should show, in addition to the total War Establishment, a surplus of 6 per cent. in both non-commissioned officers and men.

All excess beyond the above is transferred to the Depôt Companies.

The roll of the Depôt Companies must show sufficient non-commissioned officers and lance-corporals for their maximum strength, with an excess of 6 per cent.

Certain Reserve men in excess of the requirements of the Pioneer Regiment are annually transferred to the Railway and Telegraph Regiment, for duty with the Field Telegraph Detachments.

The Depôt Company Cadre of a Battalion has to keep its own roll as well as that of its Battalion, showing all non-commissioned officers and men not actually serving. It has charge of all stores and *matériel*, arms, accoutrements, and field equipment, including transport, required by its Battalion for mobilization; the book-keeping in connection with this is seen to by the subaltern Officer of the Cadre. Officers of the Cadre have from time to time to keep up their training, without interfering with their Depôt duties.

The Store Reserves have charge of the Bridge Trains and such like field equipment of their respective Battalions. They have also charge of such stores as are used in peace for training purposes.

The Pioneer Regiment is, like the Railway and Telegraph Regiment, immediately under the Chief of the General Staff in technical and military matters, but under the War Ministry in administrative business. In matters of discipline, except in certain questions reserved for the Colonel in command, the fractions of the Regiment are under the Generals Commanding the Army Corps Districts in which they happen to be, through the Officers commanding the Brigades and Divisions they belong to.

The Regimental Staff, with the Battalion stationed with it, and each detached Battalion, form in peace distinct independent corps for pay and accounts, directly responsible to the Intendanz of the Military Territorial Command concerned, and have each their own *Verwaltungs-Commission*, and *Cassa-Commission*, or Boards for Administration, Pay, and Accounts.

The *Verwaltungs-Commission* at the Headquarters of the Regiment has charge of and keeps the accounts connected with the arms, clothing, equipment, transport, &c., of the Regimental Staff, and the Battalion quartered with it, and the *Verwaltungs-Commissionen* of detached Battalions, similar duties as regards their respective Battalions, but the *Verwaltungs-Commission* at Headquarters has in addition to keep and check the rolls (*Hauptgrundbuchs-stand*) of the various fractions of the Regiment as well.

Arms, Clothing, and Accoutrements.

On a war-footing only about 2 out of 3 of the rank and file are armed with carbines, but for details on this point see Table IV.

The carbine, bayonet, and sword (*Pionnier-Säbel*) are the same as those described for the Engineers. Acting-Officer-Cadets wear the infantry Officer's sword, armourers wear the infantry non-commissioned officer's sword, and all others (servants and bâtmén excepted) are armed with the Pioneer's sword.

Non-commissioned officers armed with the carbine carry 20 rounds, and privates and lance-corporals 30 rounds each in the field. The ammunition is carried in a pouch on the waistbelt in front.

The uniform, like that of the Engineers, is that known as the German Infantry pattern in Austria. The tunic, blouse, jacket, and trousers are of a blue-grey colour, and the facings, trouser seams, &c., green; the buttons are of white metal and plain. The schako and forage cap (blue-grey) are of the Infantry pattern. The great coat and hood are of the Infantry pattern, the former having green *paroli*. The remaining articles of the kit, as well as distinctions of rank, are the same as in the Infantry. The belts are the same as in the Engineers.

The knapsack is of the Infantry pattern, but for men armed with carbines who carry each an intrenching tool, there is a conically shaped hole, or leather pipe, passing through it from top to bottom, through which the helve of the tool is passed. Men not armed with carbines carry two or more tools slung with straps.

As in the other dismounted branches of the Austrian Service, the schako and tunic are not taken into the field, the service dress being the blouse and forage cap.

The rations carried in the field are the same as described in the case of the Engineers. A Pioneer Battalion, with its 8 Bridge Trains, if united, would be allowed 10 live oxen for 4 days' consumption.

The total weight carried by the men in peace or war varies according to the tools and arms carried. The heaviest weight carried in the field is that of

the Pioneer armed with the carbine and carrying a knapsack and a pickaxe, in which case it is 24·39 kilogrammes, or 52 lbs. 14 oz.

Training.

The theoretical and practical training of the Pioneer Regiment is laid down in the "*Instruction für die Truppen Schulen des K. K. Heeres*," Part V, and other Special Regulations.

The Companies should be dismissed company drill by the end of June, and the Battalions battalion drill by the end of August.

The technical preliminary training of recruits should enable them to be employed as useful workmen in the various branches of a Pioneer's duties by the end of June.

The training of the Field and Reserve Companies is the same in every respect.

Non-commissioned officers or men who show themselves skilful in the handling of boats, &c., are given the title of "*Steuermann*," and are shown as such on the various active and reserve rolls. They wear a distinguishing badge, like the marksman's badge in the Infantry. It is something like an aiguillette, and is fastened to the button of the coat.

Men of the required trades are transferred from the Field Companies to the Store Reserve and Pioneer Store Dépôt, after satisfying all requirements as regards training.

Non-commissioned officers and men in the 2nd, 4th, and 6th Reserve year's service, are annually called up for training after the harvest. The period during which this training lasts is annually fixed by the War Minister. Reserve men as a rule always join the detachment on the roll of which their names are borne.

One-year volunteers who have passed into the Reserve, as Reserve Officers, are called out for three trainings during their Reserve Service, but Officers proper, in the Reserve, with the respective Reserve contingents, but never for more than four weeks at a time.

WAR ORGANIZATION.

The Regiment of Pioneers would form on mobilization :—

- a. A Regimental Staff.
- b. 5 Battalion Staffs.
- c. 20 Field Companies.
- d. 5 Reserve Companies.
- e. 5 Store Reserves.
- f. 2 Field Store Dépôts (from the Pioneer Store Dépôt at Klosterneuburg).

The Regimental Staff would be the same as in peace.

A Battalion Staff would comprise 5 Officers and 13 non-commissioned officers and men.

A Field or Reserve Company would comprise 5 Officers, 25 non-commissioned officers, 192 lance-corporals and privates (11 of these being drivers), 34 horses, and 7 wagons.

A Store Reserve would comprise 2 Officers, 5 non-commissioned officers, and 46 lance-corporals and privates.

A Field Store Dépôt would comprise 2 Officers, 10 non-commissioned officers, and 25 lance-corporals and privates.

The total strength of the Regiment, when mobilized, would be 181 Officers, 7,092 non-commissioned officers and men, and 676 horses. The Regiment takes annually a recruit contingent of some 880 men, and has 10 such contingents to fall back on, giving, according to the same calculation as we used in the case of the Engineers, some 7,080 men. As the number of trained

Pioneers proper required would be only about 6,750, there would thus be an excess of 330 men.

The Colonel in command would, on mobilization, join the Headquarter Staff of the Armies in the Field (*Armee-Ober-Commando*) with one of the two Captains on the Staff of the Regiment. He would then act as adviser or assistant to the Chief of the General Staff in questions concerning his branch of the service, still retaining the management of certain matters connected with promotion, &c., of the Officers, &c., of the Regiment.

The administrative management of the Regiment is transferred, on mobilization, to the Field Officer in command at the peace station of the Headquarters of the Regiment.

The Dépôt Company, on mobilization, takes over from its Battalion such men whose training is considered incomplete, and from its Store Reserve, charge of all stores and *matériel* not required for the field. The Captain commanding a Dépôt Company in peace is not, unless under very exceptional circumstances, changed on mobilization.

The number of men in a Dépôt Company may vary. In the first place, the number of untrained men that it would take over on mobilization would not always be the same. There must be, however, always 16 first-class Pioneers in a Dépôt Company at the very least. The number of first and second-class Pioneers, may, under certain circumstances, be as high as 300. (See Table III.)

As a rule, there would be a Field or Reserve Pioneer Company with two Bridge Trains and an Advanced Guard Bridge Train, to every Army Corps, but no Pioneers enter into the normal composition of Divisions.

The remaining Companies would be kept with the Reserves of Armies. Every Army would have a Pioneer Store Reserve. The Pioneer Store Dépôt would be given a strength, on mobilization, of 5 Officers, 30 non-commissioned officers, and 147 lance-corporals and privates. It would have to form 2 Field Pioneer Store Dépôts.

Field Equipment.

The Field Equipment of the Pioneers is by Regulation divided under the following headings :—

- a. The Portable Equipment.
- b. The Company tool and store wagons (*Requisiten-Wagen*).
- c. The Bridge Trains (*Kriegsbrücken-Equipagen*).
- d. The Advanced Guard Bridge Trains (*Vorhut-Brücken-Trains*).
- e. The *matériel* of the Store Reserves.
- f. The *matériel* of the Field Pioneer Store Dépôt.
- g. The Pioneer Store Dépôt at Klosterneuburg.

The Portable Equipment of the Field and Reserve Companies is intended for hasty intrenchments, timber work, &c., of the simplest kind in the field, and with it 126 men can be employed at earth works, and 72 at timber work, without using the Pioneer's sword. All Pioneers armed with carbines (with the exception of the Company shoemaker) carry an intrenching tool of some kind, and Pioneers armed with side-arms only ($\frac{1}{3}$ rd of the war establishment) either carry 2 intrenching tools, or a set of carpenter's tools.

The Portable Equipment is invariably carried in the field except when the likelihood of work having to be done is quite out of the question, when it might be carried on the Company tool and store wagons or other vehicles. Under certain circumstances, for instance with the prospect of hard work in view, the knapsacks might be carried on country carts.

In peace the Portable Equipment is occasionally carried for practice.

The Portable Equipment of a Field or Reserve Company consists of—

53 pickaxes,
 73 shovels,
 20 large axes,
 20 small axes,
 4 cross-cut saws,
 4 frame saws,
 8 chain saws,
 54 Pioneer small tool cases.

The 54 tool cases contain 12 files of various kinds, 12 chisels, 4 saw sets, 36 gimblets and augers, 8 rules, 131 lashings, 104 dogs, and 1,804 nails and spikes of various sizes.

The two Company tool and store wagons (*Requisiten-Wagen*) carry 6 pickaxes, 20 shovels, 30 axes, and 8 saws, and in addition, besides other smaller tools and stores, 4 field forges with coals and iron, and 30 kilogrammes of dynamite with fuzes, wire, firing apparatus, &c.

This is exclusive of tools, stores, and appliances carried by the Bridge Trains, as every Company is supposed to have sufficient equipment to repair broken bridges, or throw field bridges without the assistance of these.

The *Pioneer Mountain Equipment* is merely the Portable Equipment and stores of a Field or Reserve Company, pack animals being used instead of the Company tool and store wagon, and provision made for carrying half the knapsacks of the Company.

A *Bridge Train* has sufficient equipment to throw an ordinary light field bridge of 53 metres, using either fixed or floating supports. The carriages, teams, &c., are given in Table VI.

Each of the 5 Pioneer Battalions has 8 of these Trains kept in peace by their respective Store Reserves. There are besides, in peace, 16 Reserve Bridge Trains in charge of the Reserve Store Dépôt intended either for such Reserve Companies as might be formed in war, or as a general Reserve for the Field Companies. The Bridge Trains are numbered consecutively Nos. 1 to 8 belonging to the 1st Field Battalion, 9 to 16 to the 2nd Field Battalion, and so on. The Reserve Bridge Trains are numbered 41 to 56.

The Bridge Trains would be horsed by Train Squadrons Nos. 65 to 75—that is to say, two squadrons for the 8 Bridge Trains of each Battalion, and one (No. 75) for the Reserve Bridge Trains Nos. 41 to 44, so that each Train would have a *Zug* of a squadron complete. Reserve Bridge Trains Nos. 45 to 56 would, if necessary, be horsed by hired teams.

The Headquarters of the Train Squadrons furnishing teams for the Bridge Trains would be attached by the Officer Commanding the Pioneer Battalion to such Bridge Trains as had the most numerous Train (*personnel* and horses).

As long as a Bridge Train is with the Pioneer party to which it is attached for the time, the Officer commanding the Train is under the orders of the Officer commanding the Pioneers, but when it is separated from it, and is only accompanied by its own Pioneer escort, the Officer commanding the Train is in command. When a Bridge Train is marching with a Pioneer party, the Train party belongs to the latter for rations.

Bridge Trains would, in the field, be only taken from the Army Reserves and given to Army Corps or to the Pioneer Companies of the same (as a rule two to a Company), as circumstances required, or forwarded to points where large bridging operations appeared necessary.

A Bridge Train equipped for the field would receive a sergeant-major, a corporal in charge of stores, 2 smiths, and a wheelwright of the Pioneers besides an escort of at least 2 lance-corporals and 12 Pioneers from the Company to which it was attached.

The Train *personnel* would comprise in all 1 subaltern Officer, 72 non-

commissioned officers and men, and 106 horses. The total number of carriages is 19. (See Table VI.)

Advanced Guard Bridge Trains are intended for minor bridging operations such as the crossing of canals, brooks, wet ditches, &c. A Train of this description has sufficient equipment to establish an ordinary light bridge of 13·3 metres with fixed supports. The carriages, teams, &c., are given in Table VI.

As a rule there would be an Advanced Guard Bridge Train to each Army Corps belonging to its Pioneer Company. It would then belong for pay and accounts to the Store Reserve of the Battalion to which this Company belonged.

There are 14 of these Trains, numbered consecutively. Nos. 1 and 2 belong for pay and accounts to the Store Reserve of the 5th Battalion, Nos. 3 and 14 to that of the 2nd Battalion, Nos. 4 and 5 to that of the 1st Battalion, Nos. 8 and 9 to that of the 3rd Battalion, and Nos. 7 and 13 to that of the 4th Battalion. Nos. 6, 10, 11, and 12 belong to the Pioneer Store Dépôt. On mobilization they would be formed by these.

Each Advanced Guard Bridge Train would be given a permanent party of 1 non-commissioned officer and 2 Pioneers from the Store Reserve forming it. Those formed by the Pioneer Store Dépôt would receive these parties from the 5th Store Reserve of the 5th Battalion. The Train detachment would be furnished by the 1st *Zug* of the Train Squadron quartered at the Headquarters of the Army Corps, and would comprise 1 sergeant-major and 8 men with 13 horses, the total number of carriages being 3. The latter are furnished by the Store Reserves concerned. (See Table VI.)

The bridging *matériel* at present in use differs but little from the original Birago pattern introduced in the year 1841, but the pontoon is now made of steel instead of iron. The original pontoon was made of wood, and afterwards of iron. This change took place in 1859, the advantage of the iron pontoon being that it does not leak when dry, is stronger and more simple in construction, and weight for weight is more buoyant than the wooden one. The steel pontoon has the latter advantage in a higher degree.

The pontoon is in two parts, a bow piece and a middle piece, which can be coupled together. The former is 4·266 metres long (the bow itself being 1·051 metres long), and the latter 3·476 metres long, the two when joined together making a boat 7·742 metres long. The breadth on top is 1·90 metres and at the bottom 1·74 metres. The bow is 0·987 metre high, and the depth of the body 0·89 metre. The weight of the bow piece is 414·40 kilogrammes, and of the body, 397·60 kilogrammes, the weight of the two when joined being therefore 812 kilogrammes. The sinking or extreme weights that can be taken by the two parts are 4,856 and 4,882 kilogrammes respectively, that of the two joined together being therefore 9,738 kilogrammes.

The baulks are of pine, 7·08 metres long, and 0·118 by 0·158 metre in section, and have oak cleats at each end let into the pine and secured by two iron straps. There is a small iron ring at either extreme end. The weight of a baulk is 67·20 kilogrammes. The baulks do not rest on the gunwales of the pontoons, but on a central bearer running fore and aft in the pontoon and supported by transoms resting on the gunwales, and on a support resting on the joined ends of the two parts. The length of the bearer is 4·134 metres, and its section is 0·118 by 0·158 metre. It is made of pine and weighs 42 kilogrammes. The transoms are similarly of pine and weigh 15·64 kilogrammes each; they are 1·949 metres long and 0·066 by 0·158 metre in section. The support at the junction of the two parts is also of pine; it weighs 5·60 kilogrammes, and is 0·421 metre long, and 0·158 metre square in section.

The chesses are either half or whole. They are of fir or pine, and weigh

16.80 and 9.80 kilogrammes respectively. Their length and thickness are 3.265 and 0.04 metres, and they are 0.28 and 0.154 metre broad respectively like the legs of the trestles, the half chesses may be used as ribbands.

The trestles consist each of two legs, a transom, and two suspension chains. The wood used is pine.

The transom is 5.131 metres long, and 0.224 by 0.158 metre in section in the middle, and 0.224 by 0.21 metre at either end. It weighs 105.665 kilogrammes. The legs are of four different lengths, 2.528, 3.792, 5.056, and 6.327 metres, and weigh 14.192, 19.145, 26.355, and 32.655 kilogrammes respectively. A suspension chain is made in 17 links, is 2.053 metres long and weighs 14.84 kilogrammes.

There are 15 wagons in a *Bridge Train*. Each of these takes half a pontoon, and 8 six-horsed wagons (*Balken-Wagen*) carry besides baulks, 4 four-horsed wagons (*Bock-Wagen*), trestles, and 2 two-horsed wagons (*Requisiten-Wagen*), various stores and appliances. The wagons themselves differ very slightly in pattern, and they are all close locking. The weight of a *Balken-Wagen* with stores is 2,088 kilogrammes, and that of a *Bock-Wagen* with stores, 2,016 kilogrammes, complete. The weight of a two-horsed wagon with stores is 1,696 kilogrammes complete.

The stores of a Bridge Train enable a bridge of 8 bays to be thrown using 7 coupled pontoons and 2 trestles, but the number of trestles carried is 8, giving 15 fixed and floating supports, or nearly double the amount that could be used together. This arrangement enables either a pontoon or trestle bridge to be used according to circumstances, or an additional length of bridge if baulks and planking were available from other sources.

The length of a bay is 6.636 metres, measured from centre to centre of two successive supports, and consequently the total length of bridge that can be thrown with the baulks and chesses carried is 53.088 metres. The bays are always of the same length. The number of baulks in a bay is 5, and the length in the clear 4.687 metres. The roadway is 3.05 metres wide in the clear.

The bridge is calculated to take Infantry in fours, Cavalry in twos, and Field Artillery and Trains by single carriages.

If the bridge is to take heavier weights than these, each pontoon would be formed of 3 coupled pieces, and 7 baulks would be used in a bay, the length of the bay and width of the roadway remaining the same.

The strength of a bridging party is put at 1 Officer, 10 non-commissioned officers, and 72 Pioneers, and the time taken to form a bridge is from 3½ to 4 minutes per trestle bay, and from 2½ to 3½ minutes per pontoon bay.

The bridging equipment of an Advanced Guard Bridge Train consists of trestles, baulks, chesses, &c., carried on 1 four-horsed *Bock-Wagen*, and 2 four-horsed *Balken-Wagen*. No floating supports are used. The bridge would be in two bays, and the total length would be 13.30 metres.

With the two Bridge Trains and the Advanced Guard Bridge Train the would accompany an Army Corps, the total length of bridge that could be thrown with the stores carried would be 119.476 metres.

The *Store Reserves* are intended to replenish in time of war the various kinds of stores forming the Pioneer equipment that would be expended or lost from wear and tear. The kinds of stores that they would take with them in the field would depend on the nature of warfare contemplated, the character of the theatre of operations, &c. They would be carried in 7 equipment wagons (*Rüst-Wagen*). (See Table V.) These Store Reserves would as a rule be attached to the Bridge Trains of the Army Corps to which the Staff of the Pioneer Battalion concerned belonged.

The *Field Pioneer Store Depôts* are intended for the charge and storage of large quantities of bridging *matériel* of all kinds in the field, for issue to the Pioneers, and they would also act as a Reserve in second line as regards all

kinds of Pioneer Equipment, receiving the stores, as required, from the Pioneer Store Dépôt at Klosterneuburg. Field Pioneer Store Dépôts would be formed as circumstances required.

The *Pioneer Store Dépôt* at Klosterneuburg is an establishment that has to furnish the Pioneer Regiment with bridging *matériel* and all other kinds of Pioneer Stores both in peace and war. It has charge of the Reserve Bridge Trains, certain Advanced Guard Bridge Trains, and has to procure and supply both the manufactured article and raw material. In war its chief duties would be in keeping up the supply of Pioneer Stores, as these were expended.

On mobilization it would form 2 Field Pioneer Store Dépôts, as Reserves (*Reserve Anstalten*) for the Army in the field, and these would then belong to the Pioneer Regiment.

The peace and war establishments of the Pioneer Store Dépôt are as follows:—

| | Peace. | War. |
|----------------------------------|--------|-------|
| Captains | 1 | 1 |
| Subalterns | 3 | 4 |
| Sergeant-majors..... | 2 | 4 |
| Pay-sergeants..... | 1 | 1 |
| Sergeants | 4 | 8 |
| Corporals | 6 | 14 |
| Lance-corporals..... | 6 | 10 |
| 1st class Pioneers | 23 | } 131 |
| 2nd „ „ | 36 | |
| Buglers | 1 | 1 |
| Officers' servants | 4 | 5 |
| 1st class foremen of smiths..... | 1 | 1 |
| „ „ wheelwrights .. | 1 | 1 |
| „ „ ropemakers.... | 1 | 1 |
| Total | 90 | 182 |

In peace artificers would be taken when necessary from the Field Companies, but in war as far as possible from the Dépôt Companies.

Non-commissioned officers and men are armed with the Pioneer's sword only.

The Pioneer Store Dépôt is an independent corps for pay and accounts, though it belongs in every respect to the Pioneer Regiment.

For the purchase of stores and materials it has a *Zeugs-Verwaltungs-Commission*, or Store Administrative Board, the duties of which are technical, administrative, and financial.

It keeps its own roll of furloughed and reserve men.

The Captain has general charge of everything in military, technical, administrative, and financial matters, and has to procure the timber he requires from certain forests.

One of the subalterns has charge of the workshops, the second, administrative matters and accounts, and the third, the training of the men, besides certain technical work given him from time to time. The latter Officer is supposed to be able to take over, if necessary, the duties of the first two, and must therefore acquire a knowledge of their duties.

The foremen artificers have general supervision of the work done in their respective trades, and have to see that the stores received by purchase or otherwise are of the prescribed quantity and quality.

The non-commissioned officers are either employed as storekeepers or as leading men in their respective trades. In war 3 of them would have to do duty as foremen. The Pioneers are employed either as storemen or artificers.

The general work and management of the Pioneer Store Dépôt, as well as the duties and responsibilities of the *Zeugs-Verwaltungs-Commission*, are laid down in the "*Vorschrift über die Verwaltung und Verrechnung des Pionnier-Zeugs und der Zeugs Gelder*," or Regulations for the Pioneer Store Department.

Non-commissioned officers are selected for the Pioneer Store Dépôt equally as far as possible from the Pioneer Battalions, and are mainly taken owing to their proficiency in the trades required, but no man is taken who has not been thoroughly trained as a Pioneer in one of the Companies.

The Pioneer Store Dépôt is raised to a war footing by calling in its own Reserves, and artificers may, if necessary, be transferred to it from the Reserves of the Battalions.

When the Colonel Commanding the Pioneer Regiment takes the field, the Pioneer Store Dépôt is under the Field Officer remaining behind at the Regimental Headquarters.

TABLE I.—*Peace Establishment of the Fractions of the Pioneer Regiment.*

| | | Field | | Reserve | | Depôt Company Cadre. | | Store Reserve. | | Pioneer Store Depôt. | | | |
|-----------------------------------|---|---------------------|------------------------|---------|-----|----------------------------|----|-------------------|----|----------------------------|----|----|----|
| | | Company. | | | | | | | | | | | |
| Officers . | { | Captains | 1 | .. | | 1 | 1 | | 1 | 1 | | | |
| | | Subalterns | 3 | 1 | | 1 | .. | | .. | 3 | | | |
| Non-commissioned officers and men | { | with carbines | Sergeant-majors.... | 2 | .. | 1 | .. | 1 | — | — | — | — | |
| | | | Sergeants | 4 | .. | 2 | — | — | — | — | — | — | |
| | | | Corporals | 8 | .. | 4 | .. | 1 | — | — | — | — | |
| | | | Lance-corporals | 6 | .. | 4 | — | — | — | — | — | — | |
| | | | 1st class Pioneers .. | 30 | .. | 2 | .. | 1 | — | — | — | — | |
| | | | 2nd „ „ .. | 60 | .. | 5 | .. | 1 | — | — | — | — | |
| | { | without carbines | Acting-Officer-Cadets | 1 | 117 | .. | 20 | .. | 7 | .. | 6 | .. | 83 |
| | | | Sergeant-majors.... | .. | .. | .. | .. | .. | .. | .. | .. | 2 | — |
| | | | Pay-sergeants..... | 1 | .. | 1 | .. | 1 | .. | 1 | .. | 1 | — |
| | | | Sergeants | .. | .. | .. | .. | .. | .. | .. | .. | 4 | — |
| | | | Corporals | .. | .. | .. | .. | .. | .. | 1 | .. | 6 | — |
| | | | Lance-corporals | .. | .. | .. | .. | .. | .. | .. | .. | 6 | — |
| | | | 1st class Pioneers... | .. | .. | .. | .. | .. | .. | 3 | .. | 23 | — |
| | | | 2nd „ „ .. | .. | .. | .. | .. | .. | .. | .. | .. | 36 | — |
| | | | Buglers..... | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | — |
| | | | Drivers | — | — | — | — | — | — | — | — | — | — |
| | | | Officers' servants ... | 4 | .. | 1 | .. | 2 | .. | 1 | .. | 4 | — |
| Smiths (1st class foremen).... | | .. | .. | .. | .. | .. | .. | .. | .. | 1 | | | |
| Wheelwrights „ „ | | .. | .. | .. | .. | .. | .. | .. | .. | 1 | | | |
| Ropemakers „ „ | | .. | .. | .. | .. | .. | .. | .. | .. | 1 | | | |
| Total | | | 121 | 21 | | 9 | | 7 | | 90 | | | |

| | Colonel. | Lieutenant-Colonels and Majors. | Captains. | Regimental Adjutant. | Battalion Adjutants. | Quartermaster. | Surgeons. |
|-----------------------------------|----------|---------------------------------|-----------|----------------------|----------------------|----------------|-----------|
| Regimental Staff | 1 | 1 | 2 | 1 | .. | .. | .. |
| 1st Battalion | .. | 1 | .. | .. | 1 | .. | .. |
| 2nd „ | .. | 1 | .. | .. | 1 | .. | .. |
| 3rd „ | .. | 1 | .. | .. | 1 | .. | .. |
| 4th „ | .. | 1 | .. | .. | 1 | .. | .. |
| 5th „ | .. | 1 | .. | .. | 1 | .. | .. |
| Total Regiment..... | 1 | 6 | 2 | 1 | 5 | .. | .. |
| Pioneer Store Dépôt | .. | .. | .. | .. | .. | .. | .. |
| 2nd Field Pioneer Store Dépôts .. | .. | .. | .. | .. | .. | .. | .. |
| Grand Total | 1 | 6 | 2 | 1 | 5 | .. | .. |

- (a.) Of the Captains, 27 are First Class Captains, and of the suba
(b.) A united Battalion would be allowed in addition, 1 Quartermas
(c.) One of the Captains belonging to the Regimental Staff would
(d.) The Paymaster and 3 clerks would remain with the Regimenta
(e.) Half the pay-sergeants rank as sergeant-major, the remainder
(f.) For proportion of 1st and 2nd class Pioneers, see first note, Ta
(g.) For details of drivers and horses, see Foot-Notes (b), (c), (d),

| | | | | | | | | | Grand total. | | | Total combatants. | |
|------------------------|-------------|----------------------|-------------------|----------|--------|-----------|-------------------------|---------|--------------|-------------------------|---------|-------------------|-------------------------|
| class men ciers. | Horses. | | | | | Total. | | | | | | | |
| | Ropemakers. | Rid ₁ ng. | | Draught. | Spare. | Officers. | N.-C. officers and men. | Horses. | Officers. | N.-C. officers and men. | Horses. | Officers. | N.-C. officers and men. |
| | | Public property. | Private property. | | | | | | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 | 13 | 7 | 5 | — |
| .. | .. | 25 | 2 | 90 | 10 | 31 | 1,359 | 127 | 33 | 1,364 | 133 | 33 | 1,224 |
| .. | .. | 25 | 2 | 90 | 10 | 31 | 1,359 | 127 | 33 | 1,364 | 133 | 33 | 1,224 |
| .. | .. | 25 | 2 | 90 | 10 | 31 | 1,359 | 127 | 33 | 1,364 | 133 | 33 | 1,224 |
| .. | .. | 25 | 2 | 90 | 10 | 31 | 1,359 | 127 | 33 | 1,364 | 133 | 33 | 1,224 |
| .. | .. | 25 | 2 | 90 | 10 | 31 | 1,359 | 127 | 33 | 1,376 | 133 | 33 | 1,236 |
| .. | .. | 125 | 10 | 450 | 50 | 125 | 6,807 | 635 | 172 | 6,845 | 672 | 170 | 6,132 |
| 1 | 1 | .. | .. | .. | .. | 5 | 177 | .. | 5 | 177 | — | — | — |
| .. | .. | 4 | .. | .. | .. | 4 | 70 | 4 | 4 | 70 | 4 | 4 | 64 |
| 1 | 1 | 129 | 10 | 450 | 50 | 164 | 7,054 | 639 | 181 | 7,092 | 676 | 174 | 6,196 |

would be given on this point at the time.
 Headquarters with the Field Officer second in command of the Regiment.

NOTE.—An additional sergeant-major might be shown in the place of an Acting-Officer-Cadet. In a Reserve Company a Pioneer would act as bugler. In the Store Reserve the pay-sergeant would act as storekeeper, and the corporal would have charge of storehouses and workshops. The 1st class Pioneers would act as foremen of works.

TABLE III.—*War Establishment of the Fractions of the Pioneer Regiment.*

| | | Field or Reserve | Depôt | Store Reserve. | | Pioneer Store Depôt. | Field Pioneer Store Depôt. | | | | | | | |
|-----------------------------------|------------------|-----------------------------|-------|----------------|--------|----------------------|----------------------------|-----|-----|----|---|-----|---|----|
| | | Company. | | Nos. 1 to 4. | No. 5. | | | | | | | | | |
| Officers ... { Captains | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | |
| { Subalterns..... | | 4 | 3 | 1 | 1 | 4 | 1 | | | | | | | |
| Non-commissioned officers and men | With carbines | Sergeant-majors..... | 3 | 3 | ... | ... | 3 | — | | | | | | |
| | | Sergeants | 6 | 6 | 1 | 3 | ... | 3 | — | | | | | |
| | | Corporals | 14 | 14 | 1 | 3 | ... | 3 | — | | | | | |
| | | Lance-corporals | 12 | 12 | ... | ... | ... | 3 | — | | | | | |
| | | 1st class Pioneers | 108 | 180 | 4 | 12 | ... | 20 | — | | | | | |
| | | 2nd „ „ | | | | | | | | | | | | |
| | Without carbines | Acting-Officer-Cadets | 1 | 1 | — | — | — | — | — | | | | | |
| | | Sergeant-majors | ... | ... | ... | ... | 4 | — | — | | | | | |
| | | Pay-sergeants | 1 | 217 | 1 | 223 | 1 | 51 | 1 | 63 | 1 | 174 | 1 | 35 |
| | | Sergeants | ... | ... | ... | ... | ... | 8 | — | — | — | — | | |
| | | Corporals | ... | ... | 2 | 2 | ... | 14 | — | — | — | — | | |
| | | Lance-corporals | ... | ... | 4 | 4 | ... | 10 | — | — | — | — | | |
| | | 1st class Pioneers | 54 | ... | 36 | 36 | ... | 131 | — | — | — | — | | |
| | | 2nd „ „ | | | | | | | | | | | | |
| | | Buglers | 2 | 2 | ... | ... | ... | 1 | — | — | — | — | | |
| | | Drivers | 11 | — | — | — | — | — | — | — | — | — | | |
| | | Officers' servants..... | 5 | 4 | 2 | 2 | ... | 5 | ... | 2 | — | — | | |
| | | | | ... | ... | ... | ... | ... | 1 | — | — | — | | |
| | | | | ... | ... | ... | ... | ... | 1 | — | — | — | | |
| | | | | ... | ... | ... | ... | ... | 1 | — | — | — | | |
| 1st class foremen { Smiths..... | | ... | ... | ... | ... | ... | 1 | — | — | — | | | | |
| { Wheelwrights | | ... | ... | ... | ... | ... | 1 | — | — | — | | | | |
| { Ropemakers..... | | ... | ... | ... | ... | ... | 1 | — | — | — | | | | |
| Total | | 222 | 227 | 53 | 65 | 182 | 37 | | | | | | | |

NOTE.—(a.) An extra sergeant-major would be taken on the strength in case an Acting-Officer-Cadet were deficient.

(b.) Two sergeant-majors in a Field or Reserve Company would be employed as Trainmasters, 2 corporals as storekeepers for the two Bridge Trains, and 2 privates with carbines (shoemakers), would have charge of the company transport.

(c.) If the number of 1st and 2nd class Pioneers exceeds 180 men, 1 extra corporal and lance-corporal would be added for every additional 15 Pioneers, and 1 extra sergeant for every additional 30 Pioneers, and should there be 100 additional Pioneers there would be an extra subaltern and sergeant-major.

(d.) The Store Reserves supply from their war establishment each of the Bridge Trains they form, with 2 smiths and 1 wheelwright (without carbines), and each Advanced Guard Bridge Train with 1 non-commissioned officer and 2 Pioneers (with carbines) as escorts. For the Advanced Guard Bridge Trains formed by the Pioneer Store Depôt these escorts would be furnished by the Store Reserve of the 5th Pioneer Battalion.

(e.) Three non-commissioned officers in the Pioneer Store Depôt would be 2nd class foremen artificers.

(f.) As a rule, two-thirds of the Pioneers would be 1st class Pioneers.

TABLE V.—*Train of the Pioneer Regiment in War.*

| | Drivers. | Horses. | | | | | Wagons. | | | | |
|--------------------------------|----------|-------------------|-------------------|----------|--------|--------|---------------------------|--------------------------------------|--------------------------------|--------|--|
| | | Officers' riding. | | Draught. | Spare. | Total. | Deckel-Wagen, two-horsed. | Provision (Rüst-Wagen), four-horsed. | Company equipment, six-horsed. | Total. | |
| | | Public property. | Private property. | | | | | | | | |
| Regimental Staff..... | 2 | 1 | 4 | .. | .. | 5 | — | — | — | — | |
| A Battalion Staff..... | 2 | 1 | 3 | 2 | .. | 6 | 1 | .. | .. | 1 | |
| A Field or Reserve Company .. | 11 | 5 | | 18 | 2 | 25 | 1 | 1 | 2 | 5 | |
| A Store Reserve..... | .. | 2 | .. | .. | .. | 2 | — | — | — | — | |
| A Field Pioneer Store Dépôt .. | .. | 2 | .. | .. | .. | 2 | — | — | — | — | |
| Totals. | | | | | | | | | | | |
| Regimental staff..... | 2 | 1 | 4 | .. | .. | 5 | — | — | — | — | |
| 5 Battalion staffs..... | 10 | 5 | 15 | 10 | .. | 30 | 5 | .. | .. | 5 | |
| 20 Field Companies..... | 220 | 90 | 10 | 330 | 40 | 500 | 20 | 20 | 40 | 80 | |
| 5 Reserve Companies..... | 55 | 25 | .. | 90 | 10 | 125 | 5 | 5 | 10 | 20 | |
| 5 Store Reserves | .. | 10 | .. | .. | .. | 10 | — | — | — | — | |
| 2 Field Pioneer Store Dépôts | .. | 4 | .. | .. | .. | 4 | — | — | — | — | |

NOTES.

(a.) A Battalion, if united, would be allowed, besides the above, a country wagon for meat, and a Field Pioneer Store Dépôt 5, or if necessary more, country wagons, to carry its stores.

(b.) 1 driver is allowed for every spare horse and every 2 draught horses. The Colonel is allowed 2 drivers and every Battalion Commander 1 driver, as batmen.

(c.) The riding horses, public property, are for one of the Captains of the Regimental Staff, the Battalion Adjutant, and all Officers of Field and Reserve Companies Store Reserves, and Pioneer Store Dépôts, with the exception of the 10 Captains mounted in peace. There would be in addition a riding horse, the property of the public, for the Quartermaster of a united Battalion. The horses, private property, are those for which field forage allowance is issued.

(d.) The 7 four-horse *Rüst-Wagen*, to carry the stores of a Store Reserve, would be furnished by the Train Squadron (bearing an even number) furnishing the teams for the Bridge Trains of the Pioneer Battalion concerned.

TABLE VI.—*Formation and Establishment of the Bridge Trains.*

| | | A Bridge Train. | | | | | | An Advanced Guard Bridge Train. | | | | |
|--------------------------|------------------------|-----------------------------------|------------------------|---------|----------|--------|--------------|---------------------------------|------------------------|---------|----------|---------------------|
| | | Officers. | N.C. officers and men. | Horses. | | | Wagons. | | N.C. officers and men. | Horses. | | |
| | | | | Riding. | Draught. | Spare. | Four-horsed. | Six-horsed. | | Riding. | Draught. | Four-horsed wagons. |
| From the Pioneer Regt. | From the Company. | Trainmaster (sergt.-major) | 1 | — | — | — | — | — | — | — | — | — |
| | | Store-corporal | 1 | — | — | — | — | — | — | — | — | — |
| | | Smiths | 2 | — | — | — | — | — | — | — | — | — |
| | | Wheelwrights | 1 | — | — | — | — | — | — | — | — | — |
| | From the Store Reserve | Baulk wagons | .. | .. | .. | .. | .. | 8 | .. | .. | .. | 2 |
| | | Trestle wagons | .. | .. | .. | .. | .. | 4 | .. | .. | .. | 1 |
| | | Store wagons | .. | .. | .. | .. | .. | 2 | .. | .. | .. | — |
| | | N.C. officers | .. | .. | .. | .. | .. | .. | 1 | .. | .. | — |
| | From the Company. | Pioneers | .. | .. | .. | .. | .. | .. | 2 | .. | .. | — |
| | | Lance-corporals | 2 | — | — | — | — | — | — | — | — | — |
| | | Pioneers | 12 | — | — | — | — | — | — | — | — | — |
| | | Escorts. | | | | | | | | | | |
| From the Military Train. | | Subaltern | 1 | — | — | — | — | — | — | — | — | — |
| | | Sergeant-major | 1 | — | — | — | — | — | — | — | — | — |
| | | Sergeant | 1 | — | — | — | — | — | — | — | — | — |
| | | Corporals | 4 | — | — | — | — | — | — | — | — | — |
| | | Trumpeter | 1 | — | — | — | — | — | — | — | — | — |
| | | Drivers | 61 | — | — | — | — | — | — | — | — | — |
| | | Officers' servant | 1 | — | — | — | — | — | — | — | — | — |
| | | Shoeing smith | 1 | — | — | — | — | — | — | — | — | — |
| | | Smith | 1 | — | — | — | — | — | — | — | — | — |
| | | Collar-maker | 1 | — | — | — | — | — | — | — | — | — |
| | | Officers' riding horse .. | .. | 1 | — | — | — | — | — | — | — | — |
| | | N.C. officers' ditto | .. | 7 | 6 | — | — | — | — | — | — | — |
| | | Draught horses | .. | .. | 96 | — | — | — | — | — | — | — |
| | | Spare ditto | .. | .. | .. | 2 | — | — | — | — | — | — |
| | | Deckel-Wagen (1854 pattern) | .. | .. | .. | .. | 1 | — | — | — | — | — |
| | | Rüst-Wagen | .. | .. | .. | .. | 4 | — | — | — | — | — |
| | | Sergeant-major | .. | .. | .. | .. | .. | 1 | — | — | — | |
| | | Drivers | .. | .. | .. | .. | .. | 7 | — | — | — | |
| | | Smith | .. | .. | .. | .. | .. | 1 | — | — | — | |
| | | N.C.O.'s riding-horse .. | .. | .. | .. | .. | .. | .. | 1 | — | — | |
| | | Draught horses | .. | .. | .. | .. | .. | .. | .. | 12 | — | |
| | | | 1 | 91 | 8 | 102 | 2 | 5 | 14 | 12 | 1 | 3 |

NOTES.

(a.) The establishment of a Bridge Train, with the Headquarters of the Train Squadron, would consist in addition of 1 Train Captain, 1 Surgeon, 1 Veterinary Surgeon, 1 sergeant-major, 1 pay-sergeant, 6 drivers, 3 Officers' servants, 1 wheelwright, 1 Officer's riding horse (public property), 3 riding horses (private property), 1 N.C. officer's riding horse, 4 draught horses, and one four-horsed *Deckel-Wagen*; or a total of 3 Officers, 12 non-commissioned officers and men, 9 horses, and 1 wagon.

(b.) The Train is furnished by Train Squadrons Nos. 65 to 75, i.e., 2 squadrons for the eight Bridge Trains of each Battalion, the 75th Train Squadron furnishing the Train for the Reserve Bridge Trains Nos. 41 to 44; so that each Bridge Train has then a *Zug* of a Train Squadron. Train Squadrons Nos. 66, 68, 70, 72, and 74 furnish besides each a mounted sergeant, 15 drivers, and 7 four-horsed *Rüst-Wagen* for the Store Reserves.

PART III.—VARIOUS OTHER SERVICES SOMETIMES CONNECTED WITH THE ENGINEER ARM.

Signalling.

Signalling is recognized in Austria as a useful adjunct to modern warfare, but it is not an Engineer or Pioneer service.

Field Signalling Detachments (*Feld-Signal-Abtheilungen*) would only be used, as a rule, in mountain warfare or in sieges. They have no permanent existence in peace.

To provide the necessary number of trained Officers and men that would be required in war, a Field Signalling Detachment is annually formed on the 1st July, in every Army Corps Command (except in the 1st, 5th, 6th, and 7th) and the Military Command at Zara, the 15th Army Corps Command forming two.

These Detachments are formed by the Military Territorial Authorities in places suited for signalling, and are broken up when the training is considered sufficient. In the 14th Army Corps Command the Detachment is not broken up until after the manœuvres have been brought to a close.

A Field Signalling Detachment consists of 4 signalling stations numbered 1 to 4. The Detachment is known by the number of the Army Corps to which it belongs. The two Detachments of the 15th Army Corps are known as Nos. 15 and 16, and the Zara Detachment as No. 17.

A signal station comprises a non-commissioned officer and 4 men, with a signalling apparatus complete.

A Detachment comprises—

- 2 Subaltern officers,
- 8 Non-commissioned officers,
- 12 Lance-corporals and privates,
- 2 Officers' servants,
- 4 Sets of signalling apparatus complete,
- 1 ditto in reserve.

Transport would be provided by the Train. It would consist of 2 riding horses (without saddlery) and 5 pack animals, or a two-horsed country wagon, if the service were not for mountain warfare.

Officers and men are taken from the Infantry and Rifles stationed in the Command. Officers must have at least 3 years' service.

The men leave their arms with their Regiments, and are armed as signallers with revolvers and Pioneers' swords.

Officers and men wear a black and yellow band on the arm as a distinctive mark.

In war the Officers would be mounted, and there would be a certain number of mounted orderlies detailed for duty with every Detachment.

Officers and men are both borne on the strengths of their respective Regiments over and above the establishment in war.

Field Signalling Detachments are in war under the General Staff, and are attached for pay, rations, &c., to the Staff Troops of the Army Corps Command.

The system used is discs by day and lamps by night.

The details of the system followed, training, &c., are given in the "*Instruktion für den Feld-Signaldienst im K. K. Heere*," and the duties and organization in the "*Organische Bestimmungen für die Feld-Signal-Abtheilungen*."

The Electric Light.

The Electric Light does not appear to be of recognized military use as yet in the Austro-Hungarian Land Service.

Carrier Pigeons.

It is proposed to establish military carrier-pigeon establishments in the Tyrol, Transylvania, and Bosnia and Herzegovina; but beyond giving prizes to private breeders, the Austrian Government has as yet done nothing in the organization of the carrier-pigeon service.

Balloons.

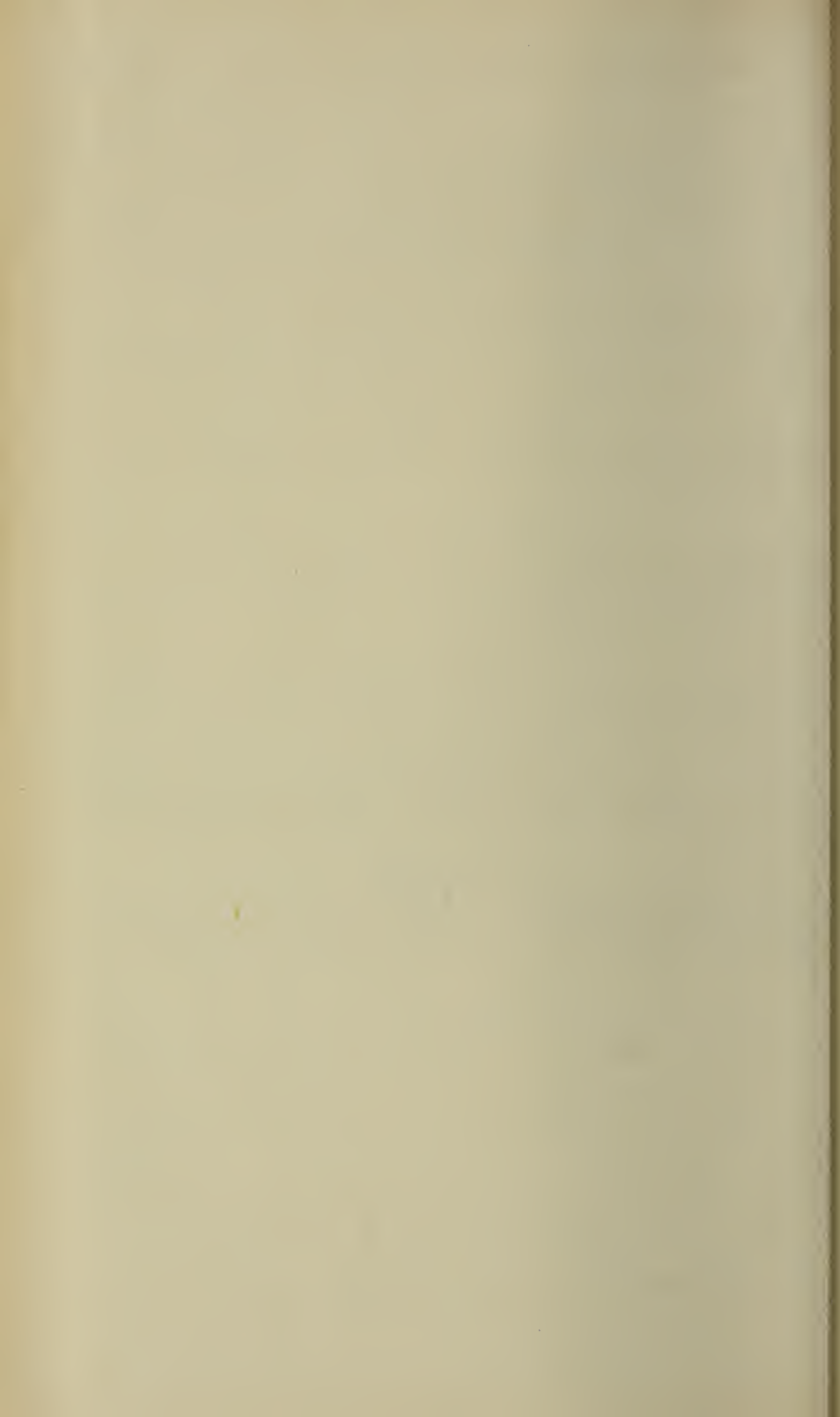
No attempt has as yet been made in Austria to organize any kind of military balloon service.

Submarine Mining.

Submarine mining and torpedo warfare is considered a naval service in Austria, and is exclusively left to the Navy. There is a torpedo school at Pola.

Railway Corps.

The Railway and Telegraph Corps is in Austria a distinct special service. There is a Railway and Telegraph Regiment, a full account of which has already been given in the Journal, No. CXXVIII, vol. XXIX (1885), page 257



REVIEWS.

Fifteen Years of Naval Retirement. By Captain P. H. COLOMB, R.N. Griffin, Portsmouth, 1886. Pp. 141. Size $8\frac{1}{2}'' \times 5\frac{1}{2}'' \times 1''$. Weight under 1 lb. 2 ozs. Price 7s. 6d.

We cannot pretend to deal fully with this question so ably handled by Captain Colomb. The Army as well as the Navy cordially concur in his opinion, p. 66: "It is impossible to argue in favour of a system which should create and maintain in the minds of State servants a notion that their object in life is to quit the Service as early as possible, and with as large a pension as possible." We fear that, save in time of war, no system of promotion or retirement satisfactory to all will be forthcoming.

Letters and Despatches of Horatio Viscount Nelson, K.B. Selected and arranged by J. K. LAUGHTON, M.A. Longmans, London, 1886. Pp. 456. Size $9'' \times 6'' \times 1\frac{1}{4}''$. Weight under $2\frac{1}{4}$ lbs. Price 16s.

Drawing on Nicolas's great work, Mr. Laughton has given us a most interesting and valuable story of Nelson's professional life. We are very glad that Mr. Laughton has not yielded to that temptation to which so many modern biographers succumb—of endeavouring to show that no man is a hero to his own valet.

Night Attacks. A Treatise on Nocturnal Tactics. By Captain R. F. JOHNSON, Brigade Major R.A. Clowes and Sons, London, 1886. Pp. 191. Size $7'' \times 5'' \times 0\frac{3}{4}''$. Weight under 12 ozs. Price 5s. 6d.

Notwithstanding the determination of Frederick the Great, quoted on the first page of this book, "never to attack by night," it is quite certain that in future wars Generals may be compelled to adopt this plan of attack; and Captain Johnson has put before us a very full and valuable collection of facts, with deductions from them to guide us in the future.

Salammô of Gustave Flaubert. Englished by M. FRENCH SHELDON, Saxon, London, 1886. Pp. 421. Size $7\frac{3}{4}'' \times 5'' \times 1\frac{1}{4}''$. Weight under $1\frac{1}{4}$ lb. Price 6s. Post free.

A realistic account of the struggle between Carthage and the mercenaries.

Elementary Military Topography. By Captain J. DEMANGEL. W. Webb, York Town, Surrey. Pp. 171. Size $8\frac{1}{2}'' \times 5\frac{1}{2}'' \times 0\frac{3}{4}''$. Weight under 1 lb. Price 9s.

This is a very complete book, and the examples given at the end of the chapters are excellent. Although it is chiefly intended for beginners, it goes also somewhat beyond the matter contained in the Synopsis of the course of instruction at the R.M.C. and the Syllabus for the examination of Officers for promotion.

Military Sketching made Easy and Military Maps Explained. By Captain H. D. HUTCHINSON, B.S.C., Garrison Instructor. Gale and Polden, Chatham. Pp. 196. Size $7\frac{1}{2}'' \times 5'' \times 0\frac{3}{4}''$. Weight under 12 ozs. Price 4s. Post free.

The Guide to obtaining a Hythe Certificate. By Captain R. W. P. LODWICK, Gloucester Regiment. Gale and Polden, Chatham. Pp. 276. Size $5\frac{1}{2}'' \times 4\frac{1}{4}'' \times 0\frac{3}{4}''$. Weight under 8 ozs. Price 3s. 6d. Post free.

Guide to Official Letter Writing, Orders, &c. By an Army Schoolmaster. Gale and Polden, Chatham. Pp. 105. Size $7\frac{1}{2}'' \times 5'' \times 0\frac{1}{8}''$. Weight under 6 ozs. Price 1s. 6d. Post free.

These books, all of the series being issued by Messrs. Gale and Polden, will be found of service in preparing for examinations, but the schoolmaster's little work is by no means the least valuable.

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FIELD-MARSHAL H.R.H. THE DUKE OF CAMBRIDGE, K.G.,
G.C.B., &c., &c., President, in the Chair.

(H.R.H. the PRINCE OF WALES was present at the meeting.)

IMPERIAL FEDERATION—NAVAL AND MILITARY.

"You know that if there is one thing more than another that I hope to live for and take part in politically, it is that, before I die, I may see the British realm a calm extending all the world over, and her children whom she has sent out themselves self-governing communities, united together in a bond of peace that shall be an example to the world."—Extract from Speech, delivered August 1, 1885, by the late W. E. FORSTER, M.P., First Chairman of the Imperial Federation League.

By Capt. J. C. R. COLOMB, formerly R.M.A.

At the time allotted it will be impossible to do more than sketch the outlines of the subject. Before proceeding to do this it is necessary to review general considerations in order to avoid confusion and not dangerous misconceptions. The main features of Imperial Federation are—

1st. The unity of the Empire.

2nd. The developments necessary to preserve it.

The first is based on the present universal acceptance of the declaration that it is to the mutual material advantage of all parts of the Empire to be united.

We have here the expression not merely of a patriotic sentiment, but a direct reference to practical utility. Sentiment is a great force, but its strength for practical purposes is in proportion to self-interest. Mutual advantage is the strongest bond, and the measures most calculated to secure the permanency of the Imperial Union are those which best foster and promote common benefits conferred by that union.

In discussing Imperial Federation from any point of view there is danger of confusion between the end sought to be accomplished and the means by which that end can be attained. The end sought is not the adoption of one particular plan or scheme for the transaction of such affairs of the Empire as are of common concern to all its parts. It is something much more simple—the strengthening of Imperial Unity. The means to secure that end are such constitutional develop-

ments of the Imperial civil, naval, and military machinery as are necessitated by progress and growth, and are by mutual consent acknowledged to be for mutual advantage.

Imperial Federation has to do with facts—commercial, political, naval, and military facts—and not with the theoretical construction of a “brand new Constitution” for the Empire. Walpole tells us that when Lord Holland was asked by an Italian Minister to draft a Constitution for the little State of Naples, he replied, “You might as well ask me to build a tree.” The Imperial Federationist does not propose to build trees, but he points to what have been long ago planted, and asks for a recognition of growth and that demands of development shall be satisfied.

Let us now briefly examine what it is we have planted; what has been the extent and nature of its growth; and what are the demands of a naval and military character made by the development of these interests, which war forces may be required at any moment to preserve.

What we have Planted.

Our flag has been planted in territories beyond sea by three distinct processes—conquest, cession, and settlement. Some portions we owe to the sword, some to diplomacy, others to the natural overflow of population. Those who think that Empire means war need to be reminded that out of eight and a half million square miles of British territory, only about one and a half million square miles have been directly acquired by war or by diplomacy. Some seven million square miles represent the proportion contributed to our Empire by the pursuits and enterprises of peace. Industrial and commercial progress has won for us some seven-eighths of our Empire. It has also created new liabilities, introduced novel conditions, and accumulated responsibilities which must be met if the unity of the Empire is to survive in war. Keeping to the special subject before us it may be said that what we have in three distinct ways planted, are new maritime and territorial conditions of British defence.

It is to be noted that the great bulk of our territory acquired by conquest or diplomacy lies in the tropics and sub-tropics. Here we have to deal with dense populations ever on the increase, and with varieties of races in every stage of progress or decay. Here also we have to deal with climatic and other conditions which forbid all prospect of the natural growth and expansion of our own race ever being really localized. These limbs of Empire, for prosperity, for protection, and for peace depend upon the strength of our influence and power. The main source of that strength must be drawn from centres of civilization which has its only permanent abiding place in the temperate zones. For protection from external attack or foreign intrigue, and for security against internal anarchy, they depend upon military and administrative means furnished from without. As component parts of our Empire their relations to the rest are the relations of the numerically strong to the numerically weak, yet of the governed to the governing power. These territories form in the aggregate an Empire of Dependencies, and in Table I (Plate XIX)

will be found a general statement as to some facts of its present conditions. It includes, as will be observed, India, the West Indies, Possessions on the West Coast of Africa, the Straits Settlements, Hong Kong, and very many other isolated positions which are in the true sense of the term dependencies, though not necessarily in the tropics or sub-tropics.

Turning now to other portions of the Empire which lie almost wholly in the temperate zones—the Dominion of Canada, Newfoundland, the Colonies of Australasia and those of British South Africa, in these the characteristic features completely differ from those presented by the Empire of Dependencies.

In British North America and Australasia populations are yet so small in proportion to area that they may in that respect be said to be at present infinitesimal. We have there but a residuum of aborigines gradually disappearing before the advance of civilization by a natural process of absorption or decay. In Canada there is a considerable population of French origin, but thoroughly loyal to the Crown. British South Africa presents circumstances of an exceptional character. There we have aboriginal races numerically immensely in excess at present of European population. The European population itself contains a preponderating proportion of Dutch origin, loyal to the Crown. In all these territories the backbone of the population is Anglo-Saxon. The populations there owe their presence to that spirit of energy and enterprise which led men and still leads them to "*home away*" from the Old World to the New. In every one of these territories climatic conditions and all circumstances favour the unrestricted growth and practically unlimited expansion of our race. Were the thirty-six millions of people crowded together in these two small islands of ours spread over the habitable portions of those territories they would still be but very sparsely populated. For internal prosperity and for progress these Colonies mainly depend upon themselves, not upon us. They look to increase of population by natural growth, and to immigration of "*bone and sinew*" from the Old World, to ensure for them a great and glorious future under the old flag. For the maintenance of social order they no longer require the guidance or the assistance of the mother country. Canada, with special internal difficulties, without any parallel in Australasia, has recently shown she needs no external help to suppress rebellion and re-establish law. Such military means as are necessary for the security of internal order are furnished from within, not from without. The relations of these component parts of the Empire to the mother country are the relations now of numerically weak to numerically strong distributions of one and the same people. They are not the relations of the governed to the governing power, but of absolute freedom based upon the common attributes of political, social, and moral equality. Our Colonies are tied to us by loyalty to the same Crown, the forces of a common sentiment, and by a sense of present mutual advantage. The bonds may be permanently injured or for ever destroyed by a war for which neither the Colonies nor we were adequately prepared.

These territories in the aggregate make up the Colonial Empire respecting which some useful information will be found in Table II (Plate XIX).

What we have planted then beyond sea may be grouped under two distinct heads, the Empire of Dependencies and the Colonial Empire. One is the artificial product, the other the natural offspring, of the Home Empire of the United Kingdom.

Table III gives, for purposes of comparison, similar information relating to the Home Empire, as already given for the other two.

A summary of all three is shown in Table IV.

The tenure by the Home Empire of the Empire of Dependencies is that of administrative capacity and of power. The association of the Colonial with the Home Empire is that of kinship, consent, and a common loyalty to a common Crown. The existing connection between the Colonial Empire and the Empire of Dependencies is through the Home Empire of the United Kingdom. They form together a trinity of strength or of weakness precisely in proportion to their power of combination for common security. That power must develop fresh strength in the ratio of the demands and necessities of growth. In other words, it depends upon the furthering now and in the future of all such measures as shall increase mutual advantages in peace, and secure organized co-operation for mutual defence in war. These are briefly the principles of Imperial Federation. They are applicable alike to political, commercial, naval, and military considerations. The recognition of their importance must precede practical action, and the realization of the influences and the facts of growth is the first step towards that recognition.

Let us now therefore briefly examine—

The Nature and Extent of Growth.

For purposes of illustrating growth it is necessary to fix standard dates. It is fitting to take as one the present time, when products of our Empire are gathered under one roof in London, and subjects of our Queen are flocking together from all parts of the world-wide dominions of the Crown. For a past date, I select the period of the great International Exhibition of 1851. Thus we shall measure during the past thirty-five years broad facts of British progress at home and abroad, such as population, trade, shipping, and revenue. Table V shows the condition of the three great divisions of our Empire in 1851. I dismiss area as evidence of growth because during this period we have not only acquired fresh territory, but have also parted with it in Europe, Africa, and North America.

For purposes of rough illustration let us take the United Kingdom on the one hand, and the whole outlying Empire on the other, and compare at these two dates—1851 and the present time—the one and the other.

Table VI so compares the population, trade, shipping, and revenue then and now. The broad lessons it teaches may be summed up as follows:—

1st. That the aggregate year's trade of the outlying Empire now

exceeds by over one hundred millions sterling the total value of the whole trade of the United Kingdom only thirty-five years ago.

2nd. While one year's trade then (1851) of the United Kingdom was nearly treble the value of the aggregate annual trade of the Empire beyond the sea, it does not now exceed it by even 50 per cent.

The movement of shipping in and out of port furnishes a standard also of relative interest on the seas and oceans of the world. The diagram illustrates these main facts:—

1st. That in 1851 the aggregate tonnage entering and clearing British ports at home was more than double the aggregate tonnage entering and clearing British ports abroad. Now, however, it will be seen the tonnage entered and cleared our ports abroad in the year is greater by some 13,000,000 tons than in the case of our ports at home. I remind you that this excess alone is about the equivalent of the total tonnage in and out of all our home ports during the year of the Great Exhibition, 1851.

Here, then, we have the creation by natural growth of new, great, changed, and changing interests requiring protection in war.

Upon readiness, sufficiency, and combined action of Fleet and Army this vast trade for its security in war entirely relies. Upon its safety depends not merely the wealth and greatness of the British Empire, but its power to lead onward and undisturbed in the civilization of the world. Upon the adequate protection of Imperial trade in war will depend not merely the comfort but the *bread* of scores of millions of toilers geographically separated by seas but under one flag. The original sources of material power of defence are men and money. Diagram VI shows not only the growing and changing interests we may have at any moment to defend, but it also indicates increase and changing positions of the material resources of dormant defensive power. The possession of such original resources as men and money is one thing, however, while their proper adaptation and sufficient appropriation for purposes of defence is another. As regards the simple fact of their possession this diagram shows—

1st. That, roughly speaking, during the last thirty-five years there has been an increase of the Queen's subjects at home of nearly 10,000,000, while over-sea the addition amounts to nearly 40,000,000.

2nd. That in 1851 the annual revenue of the United Kingdom was nearly double the aggregate revenue of the Empire beyond sea, while now the aggregate revenue of the Empire beyond sea exceeds by 22,000,000*l.* sterling that of the mother country.

Such, then, are a few broad features of these comparisons. There are many others of importance I now pass by, the subject being large and the time of explanation short. Having hastily examined what we in the past planted, and having glanced at the nature and extent of growth, let us now take a general survey of some other changes which have occurred.

It is necessary to note without remark those constitutional changes, due to Colonial growth, occurring since 1851, so far as they affect arrangements for defence. Canadian Provinces have combined and formed one great Dominion, spreading from the Atlantic to the

Pacific, with one Parliament initiating and controlling measures for its local defence. It has joined the oceans by railway communication. Newfoundland possesses a separate Parliament, charged with providing for its local defence. In South Africa there is also now a Parliament, exercising the same functions over a portion of that territory. At the Antipodes there are six separate Parliaments possessing similar powers of arrangement for the defence of six separate portions of Australasia. I merely add to this bald statement that it is quite at the discretion of these nine Parliaments, in combination with our own, with each other, or separately, to provide means of defence for these great common interests which lie beyond their shores.

While the common interests of the Empire and Parliaments have been growing, science has been busy revolutionizing the mode and means of war. The changes it has accomplished may be here sufficiently described in a few words. In the first place, it takes almost as many years now to build war-ships and great guns as in bygone times it took months. On the other hand, the use of arms of all branches of the Service in the past could be picked up in a hurry, and even during a campaign. The scientific weapons now demand long and elaborate training; in short, broadly speaking, what science has done is to enable rapid and decisive results to be produced in war, but *only* by long previous preparations and the development during peace of an organized system and plan. Effective and successful defence will therefore wholly depend in war upon the elaboration of organized arrangements and provision of means during peace. These cannot now be improvised when the time for their application has arrived. The necessary naval and military arrangements between the several parts of the same Empire to secure common safety for the common interests must be made and *paid for* in peace. They cannot be postponed until danger arises without peril. Science and systematic preparation have usurped the former places of sentiment and enthusiasm in determining the issues of war. Wealth and natural resources are nothing but temptation to attack, if their reasonable and sufficient applications to the purposes of their defence be denied.

There is a further consideration to which I must refer.

While industry and enterprise in British lands in all quarters of the globe have been swelling the value and volume of our common sea commerce, war navies have been created and naval power has been developed by nations which thirty-five years ago were not—could not be—regarded as maritime Powers. Military stations and naval bases have been established by other Powers on oceans and seas not then but now of huge Imperial importance to us. All this is only natural, only what is reasonably to be expected, but nevertheless they are facts which, as regards British defence, must not, cannot be ignored.

These broad considerations concern not simply the United Kingdom, but all territories, all industries, all manufactures, all interests, and all peoples under our "one flag." They make up a union of common war-risks against which general insurance must be paid and joint precautions taken. They can only be met with success by co-operation

and joint action between the several parts of the Empire upon a settled system and a developed plan. I am referring chiefly to British sea trade, and for the present exclude other interests from comment. In doing so, however, it must be remarked that with certain exceptions—prominently that of India—the frontiers of our Empire are practically sea frontiers. As a rule, the protection of our sea commerce is virtually the protection of our territories. Trade is territorial in its source and origin, though maritime in its main operations of exchange. I may mention in passing that the sea trade of India alone is about equal to that of Russia. It is worthy of attention that during 1851 the trade between the United Kingdom and India was officially stated at about 17 millions sterling; it is now some 86 millions a year. Thirty-five years ago the annual trade between Australia and India was in value only 150,000*l.*, it is now over three millions in value a year. The trade of the mother country has therefore five times, and that of Australia twenty times as much interest in the security and prosperity of India as they had thirty-five years ago. The territorial security of India is therefore of ever-increasing importance to the industrial and commercial classes at home and in Australia. This remark can be shown to generally apply to almost all parts of the Empire as regards India and each other. I mention these facts to avoid a possible misconception that the protection of British trade and commerce is simply a question of securing sea communications. The sources of supply must be guarded as well as the freedom of flow secured. It is helpful to a real conception of Colonial growth to remember that Australasian trade alone at this moment equals that of the Empire of Russia. The total trade of that great Empire was in 1851 but two-thirds of the total trade of Canada to-day. The aggregate sea trade of the Colonies and dependencies at the present time exceeds by some 50 millions a year that of France and Russia together. These are great maritime Powers, but our Colonies and Dependencies, with a greater aggregate of sea interests to be protected, could not produce as many armed and efficiently manned boats as these two Powers can vessels of war.

All operations of war—by land or sea—may be resolved into three original elements: place, time, and force. The places necessary to occupy are fixed by geographical circumstances. The nature and strength of the forces required are determined by the character of the places to be taken or held. Time is the factor that rules the necessities which organization has to fulfil by the production at the right places, at the right time, the right force. This very elementary statement of course applies as much to certain latitudes and longitudes on oceans and seas as to territorial positions. Sea commerce passing over the water areas of the world is governed by physical laws. The direction, volume, and value of its constant ebb and flow, so to speak, are regulated by the laws of supply and demand. Now the whole operation of protecting our sea trade is covered by two main propositions—

1st. The keeping in of the ships of the enemy that are in port when war breaks out.

2nd. Forcing all other vessels under a hostile flag off the sea, either into port or to the bottom.

The masking of hostile fleets by promptly placing, on the outbreak of war, off their war ports, the force necessary to keep them in, is an essential condition of safety of the commerce not only of the mother country but of each and all parts of the Empire. It is a joint necessity which must be provided for in order to secure reasonable safety for the whole. The fleet which keeps that of the enemy in port in one hemisphere is really protecting commerce in the other. The Colonies and dependencies for the security of their commerce will in war be as dependent as the United Kingdom on British naval power being equal and adapted to the discharge of that fundamental duty. While our commerce has been growing and foreign naval power has been developing, science has been changing the conditions of blockade: torpedo defence has benefited the blockaded, while reliance on steam, which is reliance on coal, has diminished the staying power of ships engaged in blockade. Ships outside a port must keep up steam by emptying their bunkers up their funnels. Meantime these ships will be losing speed by the natural process of fouling of immersed surface. Thus, in order to coal and in order to clean, they must constantly leave the offing, and while away their place must be taken by others. The net result of such considerations, here only indicated, is that the growth of our sea trade has made efficient blockade more imperative, while science has made that operation more difficult and more costly. The magnitude of the sea interests of the Colonies and dependencies alone demand that the necessary means shall be sufficient and available for this purpose. Our outlying Empire with over 400 millions' worth of goods on the sea in a year, is most directly concerned in the locking up of hostile fleets on the outbreak of war. Is it neither to share the cost of providing the means nor the duty and the honour of applying them to the purpose of securing its own safety? Our people at the Cape, in Canada, or Australia, are as patriotic as our fathers were when Jervis and Nelson, for the salvation of England, maintained famous blockades and fought their great sea fights. It is well to remember that the trade of British North America and South Africa together now, is about what the trade of England was when St. Vincent was fought; and that the sea commerce of Australasia alone exceeds by tens of millions the sea trade of the United Kingdom when Nelson triumphed at Trafalgar.

Now as to the other branch of operations for the defence of sea trade. Though we may blockade hostile war ports, still some of the enemy's war fleet will probably be already at sea—steamers will escape from his mercantile ports or elsewhere, armed for attack on our maritime or territorial interests. The main difference between blockade and the more extended operation of clearing the sea of hostile ships is—that in the one case our objective points are fixed points—the enemy's war ports—in the other they are ships with power of rapid locomotion. Sudden changes of position at sea and the probable absence of any clue whatever as to the direction

and objects of those changes are the chief circumstances to be met by the defence arrangements of our Empire. The power of a fleet or vessel to attack or defend interests on the high seas is in proportion to its freedom; the limits of a steamer's freedom at any point on the high seas are the coals in the bunkers *less the quantity* required to carry her to the nearest port where she can procure a fresh supply; her movements are ruled by coal-carrying capacity in relation to speed; speed is reduced by the fouling of immersed surface and general wear and tear; loss of speed is equivalent to a reduction of coal-carrying capacity, and consequently to restriction on, liberty of action.

As regards time and place, therefore, the freedom of a nation's fleet, squadron, or ship depends primarily upon the number and general distribution of national ports available for coaling, docking, and refitting. That freedom, however, is absolutely destroyed if such ports are not secured from attack wholly independently of seagoing ships. The first necessity, therefore, to the freedom of our fleet is the local and military defence of all British ports of importance at home and abroad. The chief measures to adopt in war to force hostile vessels off the sea is to employ sufficient means to make their access to their own mercantile ports, to which ocean steamers can resort, hazardous; and also to observe closely similar ports under a neutral flag.

What the naval and military organization of the Empire has to provide for, in order to secure the common commerce of each and all its parts, is the protection of these various places on the outbreak of war, the right forces to do this varied work. The safety of that commerce will entirely depend upon the promptness with which it is done. The Empire's ability to do this work quickly is a question of co-operation between its several parts involving joint expenditure, common naval and military reserves of force and of supplies. These must be adapted to, and available for, general service for the defence of our common sea trade; the interests of one are the interests of all; the duty of one is the duty of all.

The fullest freedom being secured for our seagoing forces, the next consideration is their distribution on the ocean; that must be mainly determined by the natural distribution of Imperial commerce on the high seas. The seagoing force required to protect a sea line of communication varies with its length. The longer the line, the greater the *number* of vessels necessary to protect it. The offensive or defensive *power* of the individual vessel is a tactical, but the *number* and class of vessels is a *strategical* problem—speed affects both. The importance of the line is determined by military considerations and by commercial facts. Since 1851, a process has been going on which must be noticed, having a commanding influence on the distribution of our naval force. In that year the United Kingdom drew about two-thirds of over-sea supply of wheat, wheat meal, and flour from European ports—the total amount of such food imported was some twenty-three million cwts.—the total quantity we now import is nearly treble what it was in 1851, and only about one-fifth of the whole now comes from European and Mediterranean ports. The sources of such supply have shifted across the Atlantic, and even to the other hemi-

sphere. This extension of the food lines of the mother country is equivalent to a reduction of naval power available for other services. Food lines must be made safe whatever else happens, and for this special purpose a large proportion of our maritime means must be set apart. The increased length and increased reliance on our food lines over-sea necessitates an increase of naval means to ensure their safety, unless other naval duties are to be left undone.

But in 1851 only one-fortieth of such supply came from British possessions abroad, while now the proportion is about one-fourth of that total.¹ Development of the infinite food-producing capabilities of our Empire beyond sea really corresponds to an increase of our defensive power. It may for the above reason be considered as part and parcel of the question how to secure a maximum of safety with a minimum of naval expenditure. Its solution lies in the increase of population in our own Colonies and the cultivation of our own lands over-sea. Co-operation between the mother country and the Colonies to produce this result, would be of infinite advantage to both.

The relative values of different water districts of the world to the several parts of the Empire are shown in Diagram VII (Plate XX, see also Plate XXI). It is only necessary to explain that the geographical limits of the ocean districts into which the diagram divides the world are as follows:—

North Seas Districts.—On the west by a line drawn from Dunkerque towards the Pole through Dover, the eastern boundary being the seaboard in the German Ocean and the Baltic Sea.

North-East Atlantic District is bounded on the west by 30° meridian W., on the south by the Equator, and on the east by the continuous seaboard from where the Equator strikes the West Coast of Africa to Dunkerque where it meets the limits of the North Seas.

North-West Atlantic District includes all the North Atlantic Ocean west of the 30° meridian.

South Atlantic District includes the seaboard of British South Africa with the Atlantic Ocean lying south of the Equator.

Indian Seas District takes in the water area enclosed by the continuous coast line from the north-east of British South Africa to Singapore, thence by a line, including Java, towards the South Pole and back to Delagoa Bay.

North Pacific District.—All the Pacific north of the Equator between the Indian Seas District and the American Continent.

South Pacific District.—All the Pacific south of the Equator between these limits.

These districts are also shown by dotted lines and seaboard on the map—the diagram and the map must be studied together. It is impossible now to attempt to deal with a great variety of considerations, but a careful examination of the diagram will present considerations, be it remembered, which determined the principles governing the distribution and the amount of naval and military force. I can do no more at present than indicate some of them, to show that some

¹ The most remarkable and satisfactory feature of this change is the extraordinary increase of imports from India.

form of Imperial Federation for purposes of mutual defence is *now* essentially necessary for common safety.

At first sight it may be thought that the relative value of foreign trade of the United Kingdom (A) in the North Sea and the two North Atlantic Districts entitles—for that sole reason—these districts to priority of protective precautions over all the others. It may also be thought from this first section of the diagram that the importance of our trade declines in value in the ratio of the distance of the districts from England.

From Section B it will be seen that the foreign trade of the outlying Empire is pretty equally distributed, except in the case of the South Atlantic and North Pacific.

Section C shows that the trade of the United Kingdom with the Empire over-sea is greatest with our seaboard in the Indian Ocean. On the other hand, Section D shows interchange between our possessions abroad to be greater in the South Pacific district than in any other. When, however, the last section showing the whole distribution of British trade is examined, it would still seem as if British trade to foreign seaboard in the districts nearest England was of the greatest value.¹ That is quite true as regards a state of peace, but may not and is not likely to be true when we are engaged in war. This diagram shows the relative distribution of the Empire's trade in peace, and an outbreak of maritime war would entirely change the character of the peace distribution it illustrates.

Serious danger can only arise to our sea commerce from war with a Power having seaboard within the limits of the first three districts in the diagram, *i.e.*, the North Sea, the North-east Atlantic, and the North-west Atlantic. Such Powers are the largest contributors to the foreign trade of our Empire in those three districts. The effect of war would, before a gun was fired, reduce the foreign trade of the Empire in one or more of these particular districts, by the exact amount of previous interchange between the Empire and the Power or Powers thus becoming hostile. Thus, then, the relative value of near as compared with distant ocean districts will be wholly changed. By this cause alone the commercial value of the districts of the North Seas and North-east Atlantic, *vide* A, might fall at once to half that shown in the diagram; while that of the North-west Atlantic might fall as suddenly 90 per cent. Whatever maritime war may occur, the result must be an immediate increase of the relative values of the South Atlantic, Indian Seas, and North and South Pacific districts. These three last-named, the farthest from the United Kingdom, are, we must remember, separated from it by half the world, and communicate with it by three routes:—the Suez Canal, the Cape, and

¹ This diagram does not show accumulations in the various ocean districts. For example, the whole trade of the United Kingdom with all the world accumulates in the waters of the United Kingdom, thus raising the total value of the North-east Atlantic by the value of the trade with the United Kingdom of all other districts shown in the diagram. Nor does it show the accumulation of value produced by the commerce of one district passing over another on passage. For further explanation see my tables, &c., &c., "Naval Intelligence and Protection of Commerce in War."—Journal R.U.S.I., 1881.

Cape Horn. As will be seen from the diagram, the internal trade of the Empire is greatest, but its external or foreign trade is smallest, in these three distant districts. Maritime war must accentuate the commercial reliance of the Empire upon itself, because the loss caused by commercial interchange ceasing between belligerents will seek compensation elsewhere. South Africa, Australasia, Canada, and India are great and increasing factors in the trade operations of the world, and the seaboard of the last three command the waters of the other hemisphere, while South Africa commands one of the three roads which connect them with our own.

It is just because the Pacific and Indian Oceans are so important to us, and because they are so far removed from the mother country, that we must expect attack on our sea commerce will be first delivered there. Circumstances peculiar to this half of the world have a tendency to draw towards it in peace squadrons, and war vessels of all the maritime Powers. There are international interests in Chinese and Japanese waters requiring their presence at all times. It is probable, therefore, that in an outbreak of war, more hostile cruisers will be at sea in the other hemisphere than in this. It is further to be observed that all other water areas of the world together do not present such geographical advantages for attack on our commerce as these three districts. The number of unappropriated islands, the restricted areas over which the world's commerce in those regions at present operates, offer many and great facilities for the establishment unobserved of coaling rendezvous and temporary bases for hostile ships. Our fellow-citizens in Australasia appear to be fully alive to this fact. We and they are too prone to think that the danger can be averted by the simple and cheap process of hoisting the Union Jack on a pole on an indefinite number of islands. It is not, however, the enthusiasm which hoists our own flag in peace that will secure our safety on any sea in war, but the possession of organized defensive war power capable, when the time of trouble comes, of promptly pulling hostile flags down.

By whom and how is that necessary power to be created and maintained? That is really the whole question of Imperial Federation for defence—it is one only to be settled by Home and Colonial statesmen, backed by enlightened public opinion throughout the Empire. We here are only concerned with the strategical naval and military aspects of the Empire's defence. With the civil arrangements necessary to provide the means required for common security we have nothing to do. I would, however, venture once more to repeat my own belief, expressed on many occasions here and elsewhere during the last eighteen years; it is this: that more means are likely to be provided, and that some basis of joint action would probably be settled, if responsible Ministers of Her Majesty's Home and Colonial Governments were brought together in one room and round one table, in order to confer with the responsible military and naval authorities, as to what is necessary to be mutually done for the security of our common interests in war.

As will be seen by a careful study of the last section of Diagram VII

(Plate XX), the aggregate yearly value of the trade of our Colonies and Dependencies in the South Pacific is nearly double the total annual trade of the United Kingdom in those waters. Taking annual value of commerce as a standard, the Colonies and Dependencies are very much more concerned in the safety of the South Pacific districts than the United Kingdom; deficiency in the naval and military means required to protect the trade in the South Pacific would inflict more grievous loss on our fellow-citizens in Australasia than on us. It is a question for them, for Canada, and for us conjointly to determine how the ever-increasing British trade in the Pacific is to be provided with naval and military protection. Most of the chief ports of Australasia are, by local means, secured against sea attack, and thus they are in striking contrast with some of our great commercial ports at home. The money some of these Colonies have spent, the armaments they have provided, and the local forces they maintain, are solid contributions to the freedom of our squadron in the South Pacific. That squadron may be sufficient for the purposes of peace; but can Australasia long remain satisfied with the existing arrangement, which places the reserve of ships, men, ordnance, and ammunition in the North Atlantic, and thus, at the very moment the South Pacific sorely needs them on the spot, they will be at the other side of the world?

The movable reserves of matériel and personnel in Great Britain for use in war are for general service of the Empire, and when distributed and despatched from home to the various stations, the Pacific—owing to its distance—will be the last to receive reinforcement. The delay will thus be greatest where the combined sea interests of Colonies and Dependencies are greatest, and where prompt action is most urgent.

As a short way of supplementing these remarks, I point to Diagram VIII, comparing the trade and revenue of Australasia with that of other Powers having seaboard only in the Pacific Ocean. It is to be remembered that the naval war power referred to in the margin and the war dockyards on which it rests have come into being since 1851. In the interval which has elapsed our Empire, with the greatest stake in the North and South Pacific, has done least to make the power necessary for its protection locally self-supporting in war. Does anybody think—can anybody believe, that a defensive system adapted to the ancient necessities of an island can be effective when that island has grown into an Empire and overspread the world? Those who say off-hand it is so, let them make assurance doubly sure that they are right. Let those who doubt enquire more, and it is the duty of every one who does not think so to do what in him lies to bring about a development of our naval and military arrangements adapted to the necessities of our growth.

I must now briefly and broadly refer to—

Demands of a Naval and Military Character necessitated by Growth.

Seeing the enormous extent of geographical, strategical, constitutional, commercial, and naval and military ground the whole question covers, it will be obviously impossible here to do more than faintly

indicate its salient features. To attempt a detailed survey in the time would be useless if not absurd. Each ocean district and our territories they include have varying characteristics, influencing naval and military considerations. I shall now only attempt to touch lightly upon main principles of general application, and try and illustrate them by reference to the Pacific and Indian Seas.

For clearness of such illustration we will treat the Indian Seas district as a great quadrilateral; its north side being chiefly British territory, and its corners commanded by Aden, the Cape, King George's Sound, and Singapore, the first two dominating two of the three routes connecting one hemisphere with the other. Likewise let us regard the Pacific Ocean as another parallelogram with a huge preponderating proportion of our territory in the south. King George's Sound, Port Hamilton, Vancouver, and Cape Horn at its corners, and commanded by Sydney, Vancouver, Port Hamilton, and the Falkland Islands, the latter position dominating the third water route from the other hemisphere to this. To make divisions so enormous may appear unpractical, but it must be remembered that science has and is overcoming the obstacles of distance in the practical work of the world; that our trade is with all the world, and that the helpless ships we must arrange to protect in war do from 70 to 80 per cent. of the carrying of the world's trade, and that the British sea trade to be guarded is, roughly speaking, in value alone *one-third* that of the whole world's interchange by land and sea. That is the general result of our growth, and if we are to meet the naval and military demands of growth we must not be frightened by their geographical dimensions.

Taking, then, these two great quadrilaterals, there are right places and there will be times when the defensive organization of the Empire must produce the right forces, both naval and military, for the defence of our interests within them. It must not only get the forces there promptly, but be able to sustain them so long as may be required. It will be understood that I now limit my remarks to considerations respecting the naval protection of the high seas and the military security of naval bases, they only refer to the ocean quadrilateral, not to the Indian territories. These considerations I group under three heads:—

War-ships.
Garrisons, &c.
Ordnance and stores.

Taking these in reverse order, let us glance at the necessities of defence in these quadrilaterals in war. It is only by a careful examination of such facts that we can arrive at a conclusion as to whether Federation for Defence is necessary for common safety, and if so on what principle should it be based. Where and how are we to begin?

Ordnance and Stores.

For powder and shot, guns and gun-carriages, and all ordnance

stores, our fleet and garrisons depend on Woolwich and Elswick.¹ Every shot and cartridge used by us in these two great areas must be replaced from thence. British forces in Australasia, a garrison at Port Hamilton, or our frigates off the Horn, at present must rely for these things on workshops on the Tyne and on the Thames. When an extra amount is wanted in the Pacific it will also be wanted in the Atlantic. Pressure, therefore, from all quarters of the world on the outbreak of war will be brought to bear on these establishments simultaneously.

Next comes the question of transport. Munitions of war cannot be exposed to risk of capture or destruction so long as hostile ships are at sea. Precautions must be taken to ensure the sea transit of war stores, hence they must either be escorted by war-ships or sent unconvoyed by the very fastest merchant steamers. If escorted by war-ships, naval force must be reduced elsewhere in order to furnish convoys. In this case the transports must adopt the speed of the convoys, but if the fastest war-ships are so employed, then the general protection of commerce must be left to the slower war-ships. If, however, slow war-vessels furnish the escort, then time will be lost in the delivery of stores. Supposing we rely upon speed without escort; then we are taking from our merchant marine a proportionate part of its best element of safety—speed—and so forcing an increased amount of food and other freights into slower ships, and adding to the risk of capture.

There is an economical question involved even in peace by the facts here referred to. To the cost of production must be added the cost of delivery—the further the destination from the factory the greater the expense. These considerations point more or less all one way, and may be shortly summed up by saying that the artillery requirements of the British positions, maritime and territorial, would be more certainly, promptly, and perhaps more economically met by our having a factory for production of war matériel in the Pacific. Australasia, and the western provinces of Canada both offering natural resources necessary.²

Such extension of local power of producing war matériel, whether situate in Australasia or Western Canada, would be in peace of mutual advantage to us and the Colony in which established;³ and to the whole Empire a source of incalculable strength in war. Self-support of supply of war stores in the Pacific quadrilateral appears to be a first principle on which arrangements for Imperial Federation for

¹ The resources of Indian establishments can hardly be held to be in excess of the territorial requirements of India, and therefore lie outside the question of supply of the maritime wants.

² *Vide* my remarks in "Defence of Great and Greater Britain," in 1880. (Stanford.)

³ The overcrowding of the skilled labour market at home is an increasing economic difficulty. The attraction of the surplus of the old country to the mineral resources of the new, under our own flag, could not but be beneficial were the principle applied of Government contracts to a private firm, such as a Pacific Elswick. Doubtless many contracts for war matériel made by foreign Pacific Powers would fall into its hands, instead of, as now, German, &c., firms in Europe.

defence should be based. It is simply a question of business-like practical co-operation between the Government of Her Majesty at home, and Her Majesty's Government in one or other of these Colonies. Proximity to the Indian seas seems to point rather towards Australasia than Canada as the site for such an establishment. Great things must have small beginnings, and the real danger is delay. If it be argued that this is too big a business to undertake, the reply is, the business to be done in war is bigger. Canada has recently made a small advance in this direction by the establishment of a Government cartridge factory in Quebec; and when trouble came in the north-west, this infant factory turned out in "two months over one and a half million ball cartridges."¹

Garrisons, &c.

Beyond the defended seaports of Australasia and the partially secured ports of India and of Canada, there are many others in these two great quadrilaterals of infinite importance to our fleet in war. About the most dangerous programme for any nation to adopt would be that which would provide for naval bases, armaments, and works, but which did not provide either the number of trained men necessary or the organization required to ensure their being at their posts when wanted. The defence of such ports involves, of course, three arms—the torpedo, the gun, and the rifle. The greater the advance in science, the greater the skill required in the use of weapons. Skill is a matter of training and experience; both cost money and time. If the many isolated ports in these two great areas, and elsewhere, upon which the freedom of our fleet depends have not, on the outbreak of war, the artillery, torpedo, and small-arm force required, the fact of their having works and armament only adds to naval danger. That danger can only be met by the expenditure in peace of money and time for the maintenance and training of the force required to garrison and defend the keys of our sea empire in war. What proportion of such forces may be active or reserve is a question of detail; that there shall be such forces and that they shall be at their posts when wanted, is a principle vital to the security of the commerce of the Empire.

The first point is to get the men.

Second, to train them.

Third, that they shall be available for service *where* wanted, and when wanted.

These three conditions bring us to considerations as to the distribution and the characteristics of the population of the Empire. Diagram IV shows numerical distribution,² roughly as follows: $\frac{1}{7}$ of the whole is in the United Kingdom, $\frac{6}{7}$ being beyond sea. Of the population of the outlying Empire $\frac{2}{3}$ of the total is located in the

¹ *Vide* Annual Report, Militia and Defence Canadian Blue Book, 1886.

² The address of the President, Sir Rawson Rawson, before the Statistical Society, 1884, will be found, by those not already acquainted with it, an invaluable and admirable guide to statistical information respecting British and Foreign Colonies.

Dependencies, only $\frac{1}{23}$ is in the Colonies. As regards the Dependencies, the table at the foot of Diagram I shows that out of a total of 206 millions, 200 millions are in India; the 6 millions being distributed amongst the West Indies, West Coast of Africa, and isolated possessions in various other parts of the world. Comparing the tables in Diagrams I, II, and IV, it will be seen how enormous is the number to the north of the Indian Seas quadrilateral, and how very few and far between are the populations of the Colonies in the South Pacific, or of Western Canada in the north.¹ But to whatever extent the huge numerical strength of Indian population might or could be used to furnish garrisons where necessary in the Pacific or Indian Seas, the question of artillery and torpedo service is not a question of numbers but of natural characteristics. It needs no argument, it is an obvious fact, that these arms demand, as a rule, the best talents and peculiar qualities of our own race. Assuming that such infantry force as it may be necessary to distribute for the defence of naval bases and ports in the Indian Seas and Pacific might possibly be raised in India,² the question of artillery and torpedo corps remains for consideration.

Where a naval base or coaling station is situated in our Colonies, local population offer the raw material for creating torpedo or artillery corps. At such places it is simply a question of numbers, inducements, and training. I will not stop to examine to what extent the means thus at hand have been made use of at the chief ports of Australasia or Western Canada. The important consideration is the provision for artillery and torpedo service at ports thousands of miles away from either of these seaboard, and where our own race cannot be or is not localized in sufficient numbers to furnish on the spot such corps. It may be accepted as a first principle of British sea defence that there must be an artillery and a torpedo corps and infantry available for general service at coaling ports, &c., throughout the Empire, and sufficiently strong for their needs. If this principle be not fully satisfied by the arrangements of the Empire for its defence, it is not one part of that Empire that will suffer alone, but all. It is a common necessity for the security of our common commerce. In the safety of the Pacific and Indian quadrilaterals, the commerce of our Colonies and Dependencies is first and chiefly concerned. Comparing Home and Colonial populations to areas, as shown in Diagrams II and III, it is evident the United Kingdom must be the chief recruiting ground for the rank and file of such corps. It does not follow that for the defence of our ports in the Pacific and Indian Seas this Island in the Atlantic is a suitable position for trained reserves for service in the Pacific. The argument as to time and transport referred to in the

¹ The population of British Columbia is not at present 50,000.

² This is merely assumed, not by any means intended to be asserted. There are many and great objections, and very wide differences of opinion on this point have been expressed by eminent Indian authorities. Reference to lectures, 1869-1871-1877-1878-1881, Chap. 2 and 3, "Defence of Great and Greater Britain," also "Use and Application of Marine Forces: Past, Present, and Future," Journal, 1883, will explain the views I hold as to garrisons for coaling stations.

case of war stores here points again to Australasia and Western Canada as the proper situation for training schools and depôts of forces intended for such service in those seas. The arrangements for the maintenance of such a force involves joint action and co-operation between the mother country and the Colonies in order to bridge over the chasm in the system of the Empire's defence which purely local forces cannot fill. If it be said when war comes there will be plenty of Volunteers in the Colonies and at Home for general service abroad, I think the answer is—there will be thousands ready to join the Army in the field, but probably a pinnacle would hold all the volunteer gunners, or torpedoists, or infantry that would earnestly desire to go to the Falklands, Diego Garcia, Port Hamilton, or Fiji. We cannot trust the keys of security of a thousand millions of sea commerce to patriotic sentiment; its safety in war will depend upon an organized defensive system.

To examine this military kernel of the naval nut would now take too long. The permanent strength of the artillery and torpedo corps necessary for our naval security is not so very great, but for reasons I gave in a lecture here, "On the Use and Application of Marine Forces," its organization, I venture to think, would require to be very elastic, and capable of absorbing in itself Colonial as well as home resources.

Lastly, its Colonial depôts should keep touch with each other, with their outlying detachments in dependencies, and with headquarters in the mother country, forming one force, circulating by periodic reliefs, and interchangeable between the Colonies, the Dependencies, and the mother country, by a tour of duty round the world.

The efficient maintenance of some such force suggests itself as an imperative necessity of our growth, in the satisfying of which all parts of our sea empire are equally concerned. The establishment of depôts and training schools, and the maintenance of a nucleus of a force available for general service at our out-ports in the Pacific and Indian Seas, is surely not more than obvious necessity demands. Some 35,000,000 tons of shipping annually entering and clearing our ports in that water area illustrates the interest the Colonies and Dependencies alone have in their defence. In view of the magnitude of such port-interests, Imperial Federation, naval and military, asks for that necessary, business-like co-operation of the mother country and the Colonies which can alone provide and maintain military guarantees for their security in war, for the common interests and the common good.

War Vessels.

To do full justice to this branch of the subject would require very lengthy consideration. It is only possible now to sketch roughly its boldest features.

Both as to numerical strength and description of vessels, requirements of the police duties of our fleet in the other hemisphere in peace, are wholly different from those to be fulfilled in war. It would be a waste of power and of money to employ in peace ocean cruisers

to discharge the minor but necessary duties of superintending the interests of British trade at the mouths of rivers, and at the multitude of small ports in the Pacific and Indian Seas.

The Officers and men employed in such duties in peace are available of course for service on the ocean in war, but the vessels are not. If, therefore, the vessels suitable for ocean service in the Pacific are held in reserve in our home ports in the Atlantic the outbreak of war will lock up, in vessels which cannot keep the sea, a very large proportion of naval personnel in the Pacific. War cruisers dispatched from home must, during hostilities, have full complements of Officers and men, and thus the arrival of such vessels in the Pacific some two months after they are required will do nothing at all to make available for ocean service the naval force locked up in our Pacific ports. The net result of this system would be, that while the mother country parts with naval reserves in order to dispatch war cruisers to the Pacific, an equivalent portion of the regular naval forces will remain bottled up in our ports in that ocean district, because they have no ships. On the outbreak of war, the simultaneous and prompt conversion of our naval arrangements from a peace to a war footing will be of the utmost consequence to our commerce in every ocean district of the world. The commerce of foreign Powers is so small compared to our own, that we have practically "to police" international trade in peace, at a sacrifice of naval efficiency for war. Hence it is that in distant seas foreign squadrons are more ready and are better adapted to purposes of sea attack than are ours for sea defence. It is just as much in the interests of the trade of our Colonies and Dependencies as it is the mother country's, that this necessary police work should be done. It is equally their interest that every precaution should be taken to ensure that what adds to commercial prosperity in peace shall not be a fruitful cause of the absence of adequate protection for our common sea trade in war. Here, again, co-operation is needed to secure that end, and at Colonial ports in the Pacific should ocean cruisers be held ready in reserve for war service in those seas.

As to reserves of seamen, it is on the United Kingdom and the Atlantic provinces of Canada the Empire must, for many a day to come, chiefly rely. But it is to be remembered that science is increasing the demand for seagoing, seakeeping fighting ships, while reducing the number of men required to fight them.

Such, then, would be the chief requisitions of a naval and military character made by the Empire's growth. The underlying principle common to all is a recognition of the practical difficulty of providing protection for our Empire's interests in the other hemisphere by the single-handed efforts of the population and resources of our Island in this. The difficulties are increasing, and the need for honestly facing them is very great. They can only be met by combining the resources under our flag by a comprehensive system "for the maintenance of common interests and the organized defence of common rights."¹ No such system on a settled basis is possible without co-

¹ *Vide* 4th Article of Declaration by the Imperial Federation League. Central

operation between the mother country and the Colonies. Without a defined and arranged basis of joint action, no settled system can exist and no plan for effectual defence can be carried out. The mother country and the Colonies have really now to choose between some form of Federation for mutual defence, or reaping with the Dependencies a harvest of difficulties and dangers, if not great disasters, in war.

What Imperial Federation, naval and military, really means is not "spread-eagleism;" not a declaration of "defiance" to the world; but business-like arrangements between the Colonies and the mother country for the discharge of the responsibilities and the duties of "defence." It is a duty we all owe not only to ourselves but to the two hundred millions of people in the Dependencies, for whose present interests and future safety we are each and all concerned.

To some, I fear, it will be disappointing that more has not been said in respect of Home and Colonial military forces being amalgamated for service in the field. Looking, however (Diagram IV), at the present distribution of population, and to the rates of wages at home and in the Colonies, I find myself driven to the following conclusions:—

That for some time to come no such portion of the populations as could add appreciable numerical strength to a British army in the field can be withdrawn from the Colonies for service in a prolonged campaign. The cost to the Colonies, owing to the necessarily high scale of soldier's pay, would be out of all proportion to the force produced in the field. Practical difficulties might arise from the fact that men sent from the Colonies received more pay than the men sent from home, though doing precisely the same duty. It is by no means certain that when a British army has to take the field, Colonial forces may not have plenty of work to do to defend interests near their homes, or to seize and hold naval bases established by an enemy in the Pacific or Indian Seas.

The amalgamation of Home and Colonial forces for *field* service does not urgently call for co-operation between Home and Colonial Governments. Preparation for the coming time when present relative economic conditions have somewhat changed can be by other means sufficiently met. Such means may be described in a few words. By offering every possible facility, by breaking down every bar or hindrance or custom which tends to prevent or obstruct our fellow-subjects in the Colonies from having the same opportunities and advantages of entering and advancing in the public services of the Crown, be they naval, military, or civil, which we at home enjoy. Further by a readiness to facilitate in every possible way the training of field forces in our Colonies, and at all times when offered assistance in the field by Colonial Governments to accept such proposals with prompt gratitude where and whenever possible.

Such are the germs which, if planted now, will produce the ripe fruit, in the form of Colonial field forces, in due time. That time will be hastened as population is attracted from Great Britain to the

office, 43, St. Margaret's Offices, Victoria Street, London, S.W. This League has branches throughout the Empire.

Colonies, and their great areas of fertile lands now lying waste are peopled and cultivated by our own kith and kin.

Numerical strength for the British Army for field service must be drawn from the United Kingdom and the Dependencies, not sought for in the Colonies. Officers and non-commissioned officers of Colonial forces should, however, be employed where possible with the army whenever and wherever it takes the field.

Conclusion.

It has not been possible to do more than indicate some broad principles, and illustrate them by reference to general naval and military requirements of large areas. They cover, however, a variety of special considerations which merit the greatest attention. I can now only briefly refer to one.

Since 1851 the stream of interchange between this side of the world and the other has been turned into a new channel. The Suez Canal has complicated our maritime position, and while giving us certain military advantages—so long as we can hold our own at sea—it has added to military responsibility in supporting the operations of our fleet. I would point out that such weight as may attach to my observations on ordnance and garrisons, and war vessels for the Pacific and Indian Seas, is not in the least diminished by the assumption that the Suez Canal will always be open to us in war. If, however, the probability or the possibility of the Canal being closed to us be admitted, the facts come home to the mind with accumulated force. The possibility of such an occurrence it is not reasonable wholly to ignore. The consequences to maritime security in the other hemisphere will depend upon how far we have developed to an adequate extent the resources the Empire possesses in the Pacific. The results to our position in India will be wholly determined by the precautions we have taken to provide for the most rapid and ready transit of troops by alternative routes.

The Empire's answer to a "blocked" Suez Canal has been given by Canada. The influence which the "Canadian Pacific" can exercise on our naval and military position in the far East is immense. On this point I have said so much during past years that it is only now necessary to add a few words.

Now that the railway *has* been built, the facilities it offers as a means of reinforcing India sooner and more certainly than by the Cape are generally understood. Successive Ministers holding the seals of the Colonial Office have publicly testified within the last few months to the opportunities and advantages to the whole Empire this alternative route presents. Under our existing arrangements, however, it appears that our naval and military policy to provide for our common safety must be influenced by, if not subordinated to, the department of the Post Office. There never was a stronger proof that some sort of Federation for defence is necessary to enable naval and military authority to develop in peace a settled plan for the defence of our Empire in war. When that war comes we surely

shall think more of the speed and certainty with which we can throw troops into India than of the past profits made on our own letters by the office in St. Martin's-le-Grand.

As regards the sea extension of the Canadian Pacific by subsidizing a powerful line of steamers to join Port Moody with India, *viâ* Hong Kong, and with Australasia, *viâ* Fiji—the facts as to the saving of time in communication with Hong Kong, India, and Australasia, *viâ* Vancouver, are before the public, and need no comment here. The advantages that route offers as a military road do require some special remarks.

In the first place, whether the Suez Canal be open or closed to us in war, troops *en route* to the East must pass along and close to the Atlantic sea-face of Europe. If the canal is open, the line of route will continue along the major axis of what is practically a European lake. Just in proportion to the nearness of our sea-lines to hostile or to neutral ports, so are its dangers. The more numerous the nationalities possessing commercial or war ports, the greater, under the provisions of international law, are the facilities afforded to our enemies' cruisers for coaling and supplies. Their original power of continuous attack on our sea-lines is greatest where the war or commercial resources of seaboard are most developed, and the nationality of such ports is most varied. The North-east Atlantic district presents to us the maximum of these dangers.

For these and for other reasons a military transport steaming from Liverpool or Galway to Halifax, north of Ireland, would not be exposed to the same risks in war as crossing the Bay to Gibraltar or passing from Gibraltar to Port Saïd. The remarks made as to the transport of munitions of war during hostilities applies with tenfold force in the case of troops. So far, then, the route from here to the Atlantic terminus of the Canadian Pacific line offers, as regards security, superior advantages to all others during any war with a European Power. There are more fast ocean merchant steamers employed in the lines between the mother country and North America than on any other. It is from that quarter of the globe we must wholly rely for wheat in the event of a blocked Suez Canal or other circumstances cutting off our Indian supply. The safety of our food supply in war will largely depend upon the speed of the vessels available to carry it. The safety of troopers will be more or less due to the same cause. The adoption of the Canadian Pacific route would not, therefore, dislocate our food supply arrangements. The fast ocean steamer which landed troops at Halifax or Quebec could take a return freight of wheat there, or in the neighbourhood. On the other hand, trusting to the Cape route alone as the *one alternative* military road to India, must deprive the North-west Atlantic service of a very large proportion of its best and fastest steamers at the supreme moment when for national reasons they will be most required there.

Turning now to the North Pacific—if the Sandwich Islands coal-stores are watched—the period of a fast steamer's danger, running from Vancouver to Hong Kong, or to Fiji, is limited to the few hundred miles measured from the terminal point at both ends of the

lines. There are practically no bases which would enable steamers without great staying powers keeping the sea anywhere over more than about half of the line. The expanse of water is so vast that by a slight but constant variation of the course of our steamers, we could reduce the likelihood of a hostile vessel of equal speed and staying power falling in with our steamers to the merest chance.

Besides purely military considerations in respect of India, and others specially relating to communication in war with Australia, there is another standpoint from which the question of establishing *new* lines of powerful steamers from Vancouver's to Hong Kong and Australasia should be regarded. In the first place the establishment of such a line would naturally and at private expense develop means of naval repair and refit in the waters of British Columbia. These would be available to Her Majesty's ships in war. In the next place it is material we should place ourselves in a position to promptly reinforce naval forces on the American side of the North Pacific, as well as in China and Australasian waters. If war cruisers are held in reserve at Vancouver's, as well as at Hong Kong and an Australasian port, this can be done provided we have the necessary high speed steamers to "mobilize" the naval personnel on the spot. It cannot be done if we have not localized lines of such steamers connecting Vancouver with Hong Kong, and Australasia. They would enable us to distribute Officers and seamen to war cruisers at such places, and to supplement them with Naval Reserves, drawn from the mother country or Eastern Canada in a few days.

If these conditions be fairly considered side by side with the advantages the Canadian Pacific route offers as to time, the gravity of the Imperial question referred to a departmental Committee will be more fully understood.

From the time of Sir Francis Drake to that of Sir John Franklin, England spent millions of money and sacrificed freely some of her noblest sons in the vain hope of discovering for her own advantage a natural north-west passage.

Steam and engineering science, the foresight of Canadian statesmen, and the resources of the Canadian people, have given to England and the Empire all the advantages for common defence which nature denied.

Drake, three centuries ago, failing to find it, sailed from the neighbourhood of British Columbia, eastward, on the famous voyage round the world. It is quaintly told by the historian that before departing from the American continent he set up a plate nailed to a "great faire post," whereon he engraved the name of Queen Elizabeth, as a monument of "our being there," as also of Her Majesty's "right and title to the same." In our own time the descendants of the men who with Drake encompassed the world, and defeated and destroyed the "Great Armada," were able to telegraph from these same regions to another Queen of England that they had set up a great iron way which joined two oceans, "as a monument of their being there," as also "Her Majesty's right and title to the same."

After all the lives and treasure we have thrown away in trying to

find a road to the Pacific through Arctic ice, are the advantages which Canada offers for our common defence to be weighed against some departmental difficulty concerning a two-penny halfpenny stamp? No stronger argument than this is it possible to produce in favour of Imperial Federation for Defence:—the want of some executive and administrative machinery which would raise an Empire's safety above the level of political and local party strife, and make continuity of naval and military arrangements for the defence of the Empire possible, and secure the development of a settled plan.

Lastly, I produce Table IX, comparing aggregates of our Colonial Empire with the United States. The lessons it teaches are plain and simple. Though the people of the United States love peace as much as the Colonies and we ourselves, they maintain a regular naval and military force as a ready nucleus in case of war. With a revenue only double the aggregate revenues of our self-governing Colonies, the United States spend thirteen times as much on preparation for war as our whole Colonial Empire. The sea trade of the whole United States in annual value is only some 75 per cent. in excess of the aggregate trade of British self-governed Colonies alone. Only a small proportion of the trade of the States is carried in American bottoms, most of their ocean-carrying business and practically all that of British Colonies is carried by British ships. When we are at war every British ship will be an object for attack. The States, however, with such small mercantile marine interests, spend over 3,000,000*l.* a year on naval precautions. On a seagoing force the British Colonies spend nothing at all! If the cost of naval volunteers here and there in the Colonies can be considered as "naval expenditure," in that case the last remark must be corrected by stating that the United States spend seventy-five times as much on preparations for maritime war as all our Colonies put together!

These are facts very germane indeed to the question of Imperial Federation for Defence, but upon them I can here offer no further remarks.

The Colonies showed the old spirit, when across the waves our fathers ruled, came offers of help and Colonial Volunteers to the Soudan. The native Princes of India then, and not for the first time, gave proof that, though not of the same race, they were swayed by the same sentiments. The movement of Indian Forces to the Mediterranean and the Nile illustrates, however, not merely the force of sentiment, but the value and possible extension of outlying organized power. If science has increased and is increasing difficulties to Old England and her offspring, it also offers to her and to her children as a united Empire, the means of escape from them, if we will.

We have ceased to wonder that cricket matches are arranged by telegraph between Australia and England, or rifle matches fixed between the marksmen of Canada and marksmen at home. It comes in the natural course of daily events that very soon after Canadians score "bulls'-eyes" at Wimbledon, the Australians bowl us out at Lord's. Are the gifts of science to be only applied for purposes of

the cricket field and rifle range? Are they to remain neglected and unused for want of such an Imperial system as can combine British power for British protection in war?

I commenced this paper by illustrating growth of commerce and of population, growth of shipping and of revenue. I cannot close without drawing attention to another sort of growth—the growth of war.

At the opening ceremony of the Great International Exhibition, 1851, a thanksgiving was offered up “that nations do not lift up the sword against each other, nor learn war any more.” This expressed the hope of the civilized world in those days. Now, in the thirty-five years which have since elapsed, there has been twice as much bloodshed, and more than double the money spent in war by civilized Powers than during the sixty-five years which preceded the offering up of that thanksgiving. Such is the teaching of a century. Such the vanity of human hopes.

However, therefore, we may earnestly desire peace, however much we may lament the growth of war, it is time the citizens of our “great world State” should band themselves together by Imperial Federation for Defence, if they are determined to preserve, not merely by sentiment but by sacrifice and system—that which our fathers won for us—an Empire and the freedom of the sea.

H.R.H. the DUKE OF CAMBRIDGE: Your Royal Highness, my lords, ladies, and gentlemen, it now becomes my duty, as having occupied the chair on this occasion, in the name of this large assembly to thank the gallant Officer for the very interesting and valuable lecture that he has given us this afternoon. There is only one point in which I venture a little to differ in the way he has put this question. He has put his scheme before you as a case for war—but I should rather put it as a case for peace. What he has demanded is in the interests of peace; what he asks for is really an assurance against war. I am one of those who contend that if countries such as we have heard represented to-day are prepared to meet emergencies, war is the last thing that will probably take place. On that ground I consider that instead of being a warlike, this has been an extremely peaceful lecture—a lecture which ought to open the eyes of this country and make us feel that we have an enormous Empire to defend—an Empire which I do not suppose anyone—certainly no one present—would wish to see diminished one single iota. The fact of our having a great Colonial Exhibition here this year seems to me to render what we have heard just now extremely appropriate. It so happens that there are a great many of our friends from the Colonies who are assembled in this great metropolis at this present time, and I am persuaded that they are quite as English and as old-fashioned in their feeling as any one of us. The question of federation is of course an enormous one, and it is one of the most difficult questions of the day. It is a question that perhaps will never be settled in my lifetime, but we are all tending towards it, and I do not believe there is anything more likely to bring it about than this mutual feeling of necessity of mutual defence which has been so ably advocated on the present occasion. The first point in all these questions is security. Believe me, gentlemen, if you live in security you can do anything you like—whether it is commerce or trade or manufacture, all these large and enormous questions are only to be conducted when you feel secure. Security lies at the bottom of the whole of these subjects, and if, therefore, we can provide a great security not only for our home arrangements but for our great Indian and Colonial Empire, I feel persuaded that that will do more towards federation than any other consideration that can be brought forward. Then comes the difficulty in all these matters, namely, the matter of means. We can find the men, we can build the ships, but

we must have the means to do so, and unless we have the means to do so it is impossible to make any arrangements whatever. Now there arises the great difficulty. Taxation is a very inconvenient subject to talk about. Whether you talk of it at home or whether you talk of it in the Colonies, everybody of course is anxious to point out that all these things may be deferred in order to make it less uncomfortable for the pockets of the taxpayers at the present moment. That really is the question—there is more in that than in anything else. If you are prepared to do anything in regard to the subject which has now been so ably brought before us it must cost money, and without money it cannot be done. Therefore if you, or if the country—for I do not doubt that everybody here is quite prepared to do it—if the country, and not only our home country, but if the Colonies and other portions of the Empire are not prepared to go to the expense of these preparations, it is useless to think of them at all. The only way to encourage this is to make every man feel that it is his interest to insure his property, whatever it may be; and it is really, after all, a great question of insurance. I was not aware exactly what line of argument the lecturer was about to use, and therefore you will hardly expect me to go into any details. I will also further remark, that I understand there is to be another lecture on this subject later on, and therefore I would suggest that there should not be any discussion to-day. I hope, therefore, I shall have expressed your views when I have thanked our gallant friend Captain Colomb for the very able manner in which he has brought this subject forward, and perhaps the few remarks that I have made will make you all think of the really important points which he has brought to our notice.

Monday, July 12, 1886.

SIR HENRY BARKLY, G.C.M.G., K.C.B., &c., &c., in the Chair.

DISCUSSION ON THE PAPER BY CAPTAIN J. C. R. COLOMB ON "IMPERIAL FEDERATION—NAVAL AND MILITARY," WITH A SHORT INTRODUCTORY PAPER BY SIR THOMAS BRASSEY, K.C.B., ON "NAVAL ORGANIZATION FOR COLONIAL DEFENCE."

SIR THOMAS BRASSEY: "In a paper which is not to occupy more than ten minutes, it will be necessary to keep closely to the subject before us. Until within a recent period, the naval defence of the Colonies rested exclusively on the mother country. As the larger Colonies have grown in wealth, resources, and population, they have in a worthy spirit of independence gradually assumed increased responsibilities. The Australian Colonies have undertaken the defence of their harbours, both by works on shore and by a flotilla afloat. In the construction of fortifications, the advice of Sir William Jervois and other able Officers has been followed, and no further intervention on the part of the mother country seems to be necessary in connection with other works. In the defence of their coasts and harbours by naval means the Colonies cannot as yet rely on their own unaided resources. In common with the British Admiralty they have looked to the private trade of the mother country for the construction and armament of their vessels. To build ships is a simple question of money. To man them efficiently is a far more difficult task. It is impossible to improvise the personnel of a navy; and in order to give to the Colonies the full advantage of our own naval organization, further steps should be taken for the unification and consolidation of the Imperial and Colonial naval forces. With a view to this object it has been proposed that the privilege of flying the white ensign should be conceded to the public vessels of the Colonies. There has

been some hesitation in coming to a decision on this point ; the Admiralty have no voice in the selection of Officers for the command of Colonial vessels, and they may have hesitated to incur the responsibility of allowing their flag to be hoisted on ships not under their own control. I venture to think that the difficulty would be met by entering for the Navy cadets who should be nominated by the Colonial Governments in sufficient numbers to supply the Officers required for the Colonial Naval Service. The Colonial cadets should receive their education in a school on shore, which may be established at Sydney ; the curriculum should be identical with that which is from time to time approved for the "Britannia." From this school at Sydney the cadets should pass into the naval service afloat, and should be appointed to ships on the Australian station. For their examination as Sub-Lieutenant they would proceed to Greenwich, and from the Naval University they would pass into the regular line of service. When their training ashore and afloat was completed, they would be available for the navies of the Colonies to which they belong. With a plan such as I have endeavoured very hastily to sketch out, much would I believe be done towards the consolidation of the Imperial and Colonial Navies.

"Having dealt with the organization of local naval forces for coast and harbour defence in the Colonies, we may now turn to the protection of our ocean highways. That duty must remain in the hands of the Imperial Navy, and a large reinforcement of swift and powerful cruisers should be added to the fleet. We have already a considerable number of ships built and building ; we need many more. It is not possible to place an arbitrary limit on the number of ships which we require, but it is obvious that the security of our trade will be greater in proportion as we are prepared with the means of defence. The mother country must bear her full share of the burden of defending her external trade, but the wealthy Colonies would not refuse to take their part. As a condition of granting a contribution in aid of Imperial naval expenditure, it might be stipulated by any Colonial Government, which was prepared to make such a contribution, that a certain amount of naval force should be at all times maintained in the Colonial waters, or on the routes followed by the trade of the contributing Colony. The defence of the ocean trade can be accomplished, not only more efficiently, but far more cheaply, by an Imperial Navy than by the divided efforts of the Colonies. As a preliminary and practical step, the Governments of the Australian Colonies should be invited to send representatives to a conference, at which they should be assisted by the most competent naval advice. The contingency of war should be carefully reviewed ; the naval strength to be provided should be determined ; the cost should be estimated and apportioned as between the mother country and the Colonies. By this means a basis would be laid for a plan of mutual defence for the Empire, and a first step would be made in the direction of Imperial Federation."

The CHAIRMAN (SIR HENRY BARKLY) : I will ask you to join me in a cordial vote of thanks to Sir Thomas Brassey for the short but very suggestive paper which he has just read on Naval Organization for Colonial Defence. It forms a fit supplement to the more elaborate essay read before this Institution some six weeks ago by my friend Captain Colomb, and I am glad to learn that it is intended on this occasion to take a discussion on both these papers simultaneously. In the presence of distinguished naval and military Officers, it is not for me to attempt to examine the views which are put forth in either of these papers. It is sufficient satisfaction to me to know that the subject of the defence of the Empire, which I have long regarded of such vital importance, is beginning to attract the attention which it so much deserves. I will not detain you by any lengthened observations from listening to the discussion which I believe will take place, but I cannot refrain before I sit down from congratulating Captain Colomb, and with him all friends of the unity of the Empire, upon his success in obtaining a seat in Parliament. I have not the slightest doubt that he will give effective aid to those who have already in that assembly been urging upon Her Majesty's Government the necessity of prompt attention to the defence of the Empire. I will now ask you to join with me in a vote of thanks to Sir Thomas Brassey.

Admiral Sir E. FANSHAWE: Sir Thomas Brassey in his paper mentioned more

particularly the Australian Colonies, and the plan for establishing a training school at Sydney. No doubt his idea was that the same sort of thing should be carried out in Canada, although he did not specifically refer to it in his paper.

Sir THOMAS BRASSEY: I mentioned the Australian Colonies because they had begun to provide themselves with ships, and Canada has not done very much in that way yet.

Captain E. PALLISER: I returned, Sir, ten days ago from Canada, where I had opportunities of speaking to the Minister of Militia about Imperial defence, especially in connection with the personnel of the Navy. They have 40,000 sailors, and very fine men, too, scattered about Nova Scotia, New Brunswick, and Prince Edward's Island. The idea was to bring those men into some sort of connection with our Navy. I concluded that the best way to do that was to form a naval school for gunnery. I drew up the plans and estimates of the scheme, which is in print now at the Admiralty. The able and energetic Minister, Sir Adolphe Caron, has already established three schools for artillery, one for cavalry, and three for infantry. The cost of a school for naval gunnery to train about 1,500 men annually would be the same as that of our artillery school, viz., 8,000*l.* a year. The Militia Department is not prepared to enter into that expense at present, but in course of time I believe they will be quite willing to undertake it. At present they would be very glad to see the Imperial Government co-operate, and establish a gunnery school for the sailors of the maritime provinces. Supposing 1,500 were trained in that way every year, they would be liable by the Canadian Militia Act to serve on the waters of the Pacific as well as on the Atlantic, and they could be transported from one to the other by the Canadian Pacific Railway in five days: in fact Esquimalt, which is now going to be made an arsenal, will be within easy reach of Plymouth. You cross the Atlantic in eight days, you cross the land in another five days, and then you arrive at what will soon be a powerful arsenal, dominating the Pacific, and commanding rear of the Hebrides Islands, or any other islands which may be annexed round the eastern coast of Australia. The Australians are very anxious about this, there being at present no protection. The Canadian Government, by fortifying Esquimalt, are exercising an influence on the Pacific hitherto unknown, and offering considerable protection to Australia.

Sir GEORGE BOWEN: Sir Henry Barkly and gentlemen, when I received yesterday a kind invitation from His Royal Highness the Duke of Cambridge and the Council of this Institution to come here to-day, I never dreamt for a moment that I was coming in any other capacity but as a listener, for I would not venture to express any opinion on naval and military matters in the presence of so distinguished a naval and military audience. However, I may say as a Governor of twenty-seven years' experience, principally in the Australian Colonies, that I entirely agree with the view Sir Thomas Brassey expressed in his short but very suggestive and important paper. I think it is high time that something should be done, and I am quite sure that the practical step to be taken is something like that which he suggested, namely, that the Colonies should be left with the responsibility of defending their harbours, but that they should contribute to the expense of the Imperial Navy for everything beyond the statutable limit of three miles from low water mark. That of course ought to be done by the Imperial Navy, it can be done efficiently by the Imperial Navy alone; it can be done, as Sir Thomas Brassey also remarked, much more cheaply by the Imperial Navy than in any other way, and I believe that the Colonies will be ready under proper conditions to give a fair contribution, according to their population and wealth. I believe the first step towards Federation must be to confederate our fleet, so to speak. I believe that is the first line of defence, and that must be the first thing done, and I believe the Colonies even now, without any kind of Federal Council, will be willing to contribute towards the expenses of a Navy for the general defence of the Empire. But I think that that cannot last for ever. I believe in the next thirty or forty years the Crown will have as many white subjects in the Colonies as there will be in the United Kingdom. When that time comes it is simply incredible to believe that our fellow-subjects in Australia and Canada will consent to pay their fair share to the expenses of the Imperial Army and Navy, unless they have some kind of voice in some kind of Imperial or Federal Council. I believe that we must have. English-

men living in the Colonies are just as much Englishmen as those living here; it is only a distinction of locality, not of race, or thought, or sentiment. I believe, in fact, we have already a moral federation in our common language and literature, in our common loyalty to the throne, in our glorious national hopes for the future, and our glorious national memories of the past. But I think when the Queen opened, two months ago, what may be fairly called the Imperial Exhibition at South Kensington, all patriotic Englishmen must have hoped and prayed that that Exhibition would prove to be the forerunner of some closer union with the Colonies, somewhat on the principle of the federal unity of the United States of America. Such a union would, among its many advantages to the British Empire, be a guarantee of the peace and prosperity of the whole world, because I have no doubt the great British Federation would form a friendly alliance with the great English-speaking Republic on the other side of the Atlantic. So we should see *Pax Britannica* far transcend what Pliny called the "*immensa Romanæ Pacis Majestas*." In conclusion, I repeat that I entirely concur with the remarks that fell from Sir Thomas Brassey, and I think the first step towards Federation ought to be to federate our fleet.

Sir RAWSON RAWSON: Being called upon I cannot refuse to say a word upon this subject, although I am afraid I cannot add much information. I cannot help thinking that the time has arrived at which some active steps should be taken in this matter, and it appears to me that the Colonies should receive their guidance from the Central Government. That Government has the advantage of centuries of experience, which they have not possessed; it has also a knowledge of what it can contribute towards the defence of the Colonies, and a desire to take into consideration the means of the Colonies and the needs of the Colonies. I consider, therefore, that both in our War Office and in our Admiralty one Officer should be specially appointed to consider the best means of the defence of our several Colonies. If the business of a number of Commissioners or a number of high Officers in the War Office is so great and so various that they cannot apply their minds and devote their time to the special consideration of this great subject, I conceive that it would be of the greatest advantage in each of those departments that an Officer specially qualified should be appointed, as a Moltke in Germany, to consider, not how we can take the aggressive against our neighbours, but how we can best establish the means of defending our own outlying possessions; and that the business of this Officer should be to communicate with the several Colonies, to know their wishes and their dispositions. In that way the Colonies would know that they had a particular Officer in those departments to attend to their interests, because those who have the arrangement of Government offices know how these questions which are burning and may suddenly burst into a flame are put aside for something more immediately pressing, or which interests more the political parties at the head of those Departments. I cannot offer any original observations worth listening to. I can only give you general views in accordance with those which I have heard expressed here upon the subject. I think the time has come when the proposals put forward will ripen into something that will carry out the views of those who are so anxious to bring the Colonies and the mother country together; but my own conviction is that nothing as regards our defence would contribute more to the practical purpose than the appointment of such Officers as I have suggested in the Naval and Military Departments.

Captain P. H. COLOMB, R.N.: Our attention, I think, is properly confined to the title of the paper that was read the other day, "Imperial Federation—Naval and Military." I hardly think that it is our business to consider the larger political questions which were brought before us in a subsequent lecture. It has been said by many of the public papers that the keynote of Federation is the question of defence. I think that is very truly said. If you reflect for a moment you will see that the Australian Colonies are brought into very close relations with a peculiar side of European politics, and every man in Australia must be considering this, that if the Australian Colonies had to fall back on their own means for their defence, they would be no match for those European countries with which they are brought into close contact. In Canada the same thought must be prevalent amongst the population; of themselves they could do nothing against any aggressive advance

of the great country that borders them. The Colonies must know now that they cannot take what I may call monastic views, and retire into the cloisters of commerce. Those cloisters are not closed; instead of being able to shut themselves up from the rest of the world, they find that they are being more and more brought into close relations with it, and the thought must be continually before them as to what would happen if the rest of the world becomes disturbed. Then I think that they must consider upon the whole that, though there are dangers in union with the country which is more closely mixed up than themselves with European politics, the dangers of union are less, after all is said and done, than the dangers of disunion. I think that thought must fix itself in their minds. The next point that follows is, that union in matters of defence with the mother country must be much less expensive than if they had to depend upon their own exertions. The lecturer the other day pointed out how the South American small countries were upholding a large and expensive seagoing defence, and there we have on the chart before us, Chili supplying eight sea-going modern ironclad cruisers, and Peru having suffered from the want of such things. And the Colonies must recollect that they will have to provide some defence of that sort if they come to a question of disunion with the mother country. The general thought must be that after all is said and done, a union between the mother country and the Colonies for the purpose of defence, must be a federation of peace. If this country, with the assistance of her Colonies, maintains an absolute empire of the sea, which cannot be threatened in any way, you may be quite sure the peace of the world for generations to come will be secured. It was said in some criticisms on my brother's paper, that we all at his meeting were a set of Jingoos: that we were asking people to build ironclads that would not steer, and to make guns that burst, and that the whole question was spending more money. That certainly is not my view. My view is that we were gathered together in this Institution, and are gathered together now, in the interests of peace, and that we want only such money spent as is necessary to maintain peace. Well, now, passing on to the question which is more immediately before us, that of naval and military defence, we have to recollect that there are the two things, as Sir Thomas Brassey has brought them before us, there is the question of local defence, and there is the question of general defence. Now if you think of the English Army and the English Navy, you ought to look upon them as striking instruments. They are not so much instruments of defence, that is to say, they are not restricted to portions of our own territory: for the defence of those portions, they are the chisels to be driven home into the heart of our enemies when the time comes. There is, besides, local defence, and the point before us seems to me to be, that we should be very careful not to allow any question of local defence to interfere in the slightest degree with the questions of general defence. I am sorry to find that, if I rightly understood Sir Thomas Brassey, I am in some degree opposed to his view. He seems to speak, as far as I understand him, of establishing a sort of Colonial Navy in Australia; I think that would be a very dangerous thing.

Sir THOMAS BRASSEY: Only for harbour defence.

Captain COLOMB: If it is only harbour defence, then I think our ground is clear. Harbour defence is, in my opinion, properly turned over to Volunteers and Militia, naval and military. I look upon that as the keynote of the whole question, that the striking forces that I have spoken of, the Army and the Navy, must be perfectly free, must never be trammelled with any questions of local defence. They must be free to strike wherever a blow is wanted, and we must not hamper ourselves by tying them up in any way for the question of local defence. Sir Thomas Brassey said that it was impossible to improvise the personnel of the Navy. I most thoroughly agree with him. Unfortunately for us, and I regret that Sir Thomas Brassey himself has been one of the supporters of it on one occasion, there has arisen some sort of notion that in some way we can improvise the personnel. It is hoped that when the time comes you may get sufficient scratch Officers to do the work. So far as the naval force of men in this country is concerned, we are doing very well indeed; we have the active Navy, and we have the first Reserve of highly trained men in the Coast-guard, and a further reserve of very fairly trained men—some of the finest men that England produces—in the Naval Reserves. Those men, I take it, possibly with some addition from Canada, must form the personnel.

I do not think there is any difficulty in getting the proper number of men, and it is not very expensive work to train them. When you come to the Officers, it is a much more difficult question. Unfortunately the policy of the present day has been to hope that you may deal with scratch Officers, and therefore for those extensions that are before us we find ourselves with no reserve of Officers whatever. That is the most dangerous part. Speaking of the Officers, I think your object would be, not at all to enter your cadets and to train them in the Australasian Colonies, but to promote a large influx from the Colonies into the Imperial Navy, without any distinction whatever. I totally disagree with the idea of bringing in Officers who are to be specially Colonial Officers, those, as I said before, are required for local defence, but they must be in the form of Volunteers and Militia, who are quite competent to do the work.

Admiral the Rt. Hon. Sir JOHN D. HAY: I have attended on the former occasions when this subject was under discussion, and I am sure we are very grateful to Captain Colomb for having given us the information which he has, as well as to Sir Thomas Brassey for the paper which he has just read. And I am very glad to hear from speakers to-day, both those who are acquainted with the Colonies and those acquainted with the Services, that Imperial Federation must begin with the Navy. That appears to be the view also of Mr. Froude. All of us have probably read "*Oceana*," and he has given us information there which shows that throughout those Colonies in which he passed some time that was the general feeling. Sir Thomas Brassey specially alluded to the Australasian Colonies, and therefore, although I know that he means the proposition to be co-extensive with other Colonies, at least with Canada, I should like to allude particularly to the Pacific and to the Australian Colonies. I should like to guard the Colonists against contributing in money alone to the Imperial defence. With a democratic House of Commons the contribution of a large amount from the Colonies would mean diminished Navy Estimates at home. I think that they in contributing should take care that they have *quid pro quo*—that they have something in hand which would ensure the expenditure of the mother country in their defence as well as in its own. Sir Thomas Brassey, and with his experience, and the weight of his authority, I am sure we must have heard it with satisfaction, has pointed out that in spite of naval scares and the exertions made by himself and others to endeavour to get the country to give us a sufficient number of ships for our defence, we have nothing like it as yet, and it is quite certain if the mother country were at war, especially at war with a European Power, the result would be that all the ships we possess would be wanted for the North Atlantic and for the Mediterranean, and that the Colonies would be left out in the cold; their commerce would be left out in the cold, and unless some preparation is made for the defence of that commerce it would suffer enormously. Just let us remember the state of things when war was anticipated four years ago. And when I speak of ironclad ships it will be understood that with an ironclad ship, as our friend Admiral Fremantle has pointed out, there must be a certain number of other ships associated, but I speak of the ironclad as a unit which gives the key to the number of vessels likely to be required. In the Pacific there were at that time four Russian, six French, and I think four Chilean ironclads,—there were some thirteen efficient ironclad ships, and I believe the most we ever mustered there was something like four or five—the flagship in the Pacific, the flagship in Australia, and some three in China. Australasia and Western Canada ought to protect the Pacific,—the commerce of the Pacific ought to be entirely protected by them. But I agree with my gallant friend Captain Colomb, and I think with Sir George Bowen, that there must be a unity of command, and that the Imperial Admiralty must have the direction of the forces. Let us assume that Canada for the Pacific contributes in kind two ironclads with the additional ships necessary for them, and that each of the great Australian Colonies, according to their degree, produce the same, two for New South Wales, two for Victoria, and perhaps one for Queensland, one for New Zealand, and another perhaps conjointly for South Australia and West Australia, or Tasmania, speaking of it without giving the absolute numbers: and say that India again contributes four ironclads for the defence of the Indian Ocean, you then have the certainty that you would have in these seas a sufficient fleet to protect them, and the Colonies would have the

mother country in hand this way that they would say, "We will contract for the manning of these ships on condition that they serve here,—if not those particular ships, equivalent ships." If the "Sydney" or "Melbourne" is moved to the Mediterranean then equivalent ships must be sent into those seas, but the training of the Officers ought to be identical. I am not persuaded by Sir Thomas Brassey's eloquence that it would be desirable to have a subsidiary colonial training for Officers. I believe in having them sufficiently educated, as they can be, in the public schools there to pass the necessary preliminary examination for entering the Navy, and having them examined to save them the trouble of being sent home until they were pronounced fit. I am glad to see the age of sixteen is to be the time at which they are to commence their examination now. Lads of sixteen having passed their examination should go home and should be trained with the same associates and should rise to the same rank and in the same manner. I do not think it at all necessary that the thirteen ships in the Pacific should be commanded by Australian or Canadian Officers. A Canadian or Australasian Admiral would give as good an account of the enemy as could be required, but let him command in the Mediterranean,—if it is necessary he could command as well there. Let him take his turn with other Officers, and let them be identical in all respects and not be earmarked as belonging to Australasia, or as belonging to India, or as belonging to the Cape or anywhere else. Let them belong to the great Imperial Navy and be ready to take their share in the Imperial defences. I believe that a contribution partly in kind from Canada, Australia, and other Colonies, if they were willing to join or could afford it, and the amalgamation of the youth of Australasia and Canada and the other Colonies with Englishmen, Irishmen, and Scotchmen who are serving in the Navy, would bring about a unity of force and sentiment which would go far to complete the Imperial Federation, about which I am not going to trouble the meeting. But I thought it was worth while suggesting to the distinguished Colonists who are here that there is a democratic House of Commons, and that it is very uncertain whether a contribution in money from the Colonies would not mean a saving of the taxpayers at home. That is not what we want. What we want is an efficient fleet, a fleet with a sufficient number of ships which Sir Thomas Brassey, with all his authority, has not been able to get from this country, and which if the Colonies are in earnest they will be able to give us.

MR. LABILLIÈRE: I am sorry that I had not the advantage of hearing Captain Colomb's paper, having been unavoidably prevented from attending on the day it was read. There is one branch of the subject upon which I should like to say a few words. We have already heard the naval aspect of the question discussed, and I should like to speak, although a civilian, upon the military aspect of the question. I am induced to do so because I was very much struck by the admirable speech I heard delivered by His Royal Highness the Commander-in-Chief at the Imperial Federation banquet the week before last, and more particularly with the remarks of the Duke of Cambridge expressing regret that Imperial troops had been altogether withdrawn from the Colonies. That has always been my feeling. As a native-born Colonist I have always thought that it was an immense advantage that the colonial-born youth should see the red-coats amongst them. One of my very earliest and most distinct recollections is that of having seen, when a small child, some red-coats marching along the streets of Melbourne: and I do not know how far the Imperial sentiment, which has grown with my growth, and strengthened with my strength, may have originated with the sight of those troops. I therefore, as a native-born Colonist, should like to see Imperial troops with the old red coat in all our Colonies, if for no other purposes than this, that Imperial sentiments should be fostered among the native youth. But beyond that, there would be a great practical advantage. We have heard to-day about the Colonies providing ships of war according to their means. Now although the Colonial forces are very efficient, and we have had a striking example of it in that regiment sent to Suakin, I think it would be a great advantage to the Colonies if they had always regiments of Imperial troops amongst them, to set before them the highest standard of Imperial drill. I believe it could be done in this way. According to the more recent military system of organization, instead of regiments being known by numbers, they

are distinguished by their territorial names. To us civilians this has caused a good deal of confusion, for we have now to remember regiments by the names of counties, the "Middlesex" regiment, the "Surrey" regiment, the "Somerset" regiment, and so on. Now one way of giving practical force to the idea thrown out by Professor Seeley, that the Colonies are the expansions of England—"so many Kents"—would be to add to our Imperial Army, Colonial regiments. Let us have, if you like it, the 1st, 2nd, 3rd, and 4th Australian or Canadian regiments, or perhaps, better still, let each one of the Colonies maintain an Imperial regiment. Let us have the "New South Wales" regiment," the "Victoria" regiment, the "Queensland" regiment, the "Ontario" regiment, and so on, the headquarters of those regiments being in the particular Colonies from which they are named. But in order to keep them thoroughly in line with other Imperial troops, I think it would be necessary that they should be from time to time brigaded with large portions of the Imperial forces, and therefore that each Imperial regiment thus territorially assigned to any Colony should spend one year out of every three or four brigaded with troops either in this country or in India. Of course there would be some expense attached to moving troops backwards and forwards, but that would not be very serious. We have plenty of transports; we must always feed the troops, wherever they are, and the only expense would be merely their conveyance backwards and forwards. What was suggested by Sir John Hay ought to be done with regard to these troops; there should be an understanding with the Colonies that they should never be left without Imperial troops. It was upon this point that the difficulty arose with regard to leaving Imperial troops in Australia. The Australian Colonies were each willing to have kept a regiment if the Imperial Government had given a promise that those regiments should not be withdrawn in time of war; and I think it would be essential to the carrying out of the scheme which I venture to propound, that such a guarantee should be given, so that when the Colonial Imperial regiment was to be taken away for the purpose of being brigaded with troops elsewhere, another regiment should be brought in its place. Then with regard to the officering, I think that precisely the view recommended by Captain Colomb, R.N., and Sir John Hay, with regard to the officering of the Navy, ought to be carried out in the officering of these Imperial regiments. I think it would be a very undesirable thing that the "New South Wales" regiment, or the "Victoria" regiment, or the "Ontario" regiment should be officered exclusively by Canadians or Australians. It should be done in this way. Each Colony having an Imperial regiment should be given a number of commissions, at least corresponding to the number of Officers in its regiment, and those commissions should be conferred upon Colonial youths, but not for the most part to be held in the Imperial regiment of the particular Colony, but be scattered throughout the Service. Thus, what is recommended by Sir John D. Hay and Captain Colomb, R.N., would be thoroughly carried out. With regard to the Navy, we should have Colonial-born Officers in many of our ships of war, and we should have many Colonial-born Officers in a great many of our regiments, and the Imperial idea of there being no distinction between people of the mother country and Colonies would be fully carried out. I shall not venture to dwell any further upon this matter. I perfectly agree that, although we ought to keep steadfastly in view the point for which we are steering—the complete organization and ultimate perfect Federation of our Empire—there are a great many practical things in that direction which we can do at once, and there is nothing more practical than the thorough organization of our military and naval defence. We shall not only be placing the whole Empire in a position of security, but we shall help ourselves on very considerably to the ultimate goal, Imperial Federation, for it will be found that, in order efficiently and thoroughly to carry out our system of defence, we must have joint representation, and joint representation means Imperial Federation.

Captain J. C. R. COLOMB, M.P.: I think after the very admirable speeches we have had there is nothing in fact left for me to reply to, as far as my paper is concerned. There are just one or two observations I should wish to make with regard to Sir Thomas Brassey's paper. If Sir Thomas Brassey means the creation of separate Colonial navies, then I am very much afraid I am entirely out of all accord with him.

Sir THOMAS BRASSEY: Only for harbour defence.

Captain J. C. R. COLOMB: I am glad to hear it, because I think we must see at once what we have to do. The Navy has originated and grown up with the assumption that the United Kingdom is the whole Empire. That is now changed, and our Empire is spread over the world. We want an Imperial Navy. What has happened is this. We call our Navy an Imperial Navy, but it is not Imperial in any sense of the word. It is the Navy of the people of the United Kingdom only. That is one of the reasons for the state of things Sir John Hay called to our notice. The people of the United Kingdom, therefore, do what they like with it. They cut it down one day, and increase it the next; in fact they are most often engaged in cutting down, but at all events the Navy Estimates are framed not according to the Imperial interests, but to meet a party division, or from fear of the front Opposition bench. Therefore the main point that occurs to me is, that so long as your defence, which is Imperial, is mixed up and controlled by a Parliament which deals also with local affairs, so long will your Imperial questions, such as defence, go to the wall. The step to be taken is to raise it above the purely local influence of the United Kingdom. I therefore agree with Sir John Hay in the broad fact that if you are going to have an Imperial Navy it must be by aid of Colonial contributions, and it must be put absolutely out of the power of the local politics in the United Kingdom alone to interfere with its required strength. With regard to what fell from Mr. Labillière, who has done so much on this question of Federation, I should wish to say we have to bear in mind that we are growing, and that the balance of British power is shifting every day, shifting over the sea, and all you can hope to do at present is to make use of the materials of naval strength as they come to hand, and graft them into one Imperial system. The fact is we have no definite Imperial policy. Take that very question of the withdrawal of troops from the Colonies. I maintain it is not only a loss to the Colonies, but it is a loss to the Army, and in this way. I take it much of the efficiency of our Officers and men would be due to the fact that they have served in different climates on expeditions through different territories, under different climatic conditions, and learnt to accommodate themselves to circumstances. When our troops were quartered in our Colonies, the Officers had opportunities of taking part in many shooting, fishing, and exploring expeditions, and thus acquired practical knowledge of roughing it; therefore when they were ordered on a campaign they knew how to direct their men, because they had had personal experience, an experience that they never could pick up in camp or on parade. It comes not by nature, but by knowledge picked up in roughing it, and it is only by bringing Officers under those circumstances of roughing it in peace that you get experience available in war. With regard to the withdrawal of troops, we had no policy at all, and I will content myself by pointing that out as a warning with reference to what we are doing now. First I take the Army. It is quite true that the Australian Colonies did offer to pay for troops, provided that they were left there during war. But they stipulated also for the number that they were prepared to pay for in peace. That number was objected to by our Government, on this ground, that as a battery of artillery was so many men, and a regiment of the line was so many men, that meeting the wishes of the Colonies with regard to the number would interfere with the organization of the Army. But, Sir, before the last troops landed from the Colonies in this country, we had altered the organization of the Army altogether, and accordingly that pretty well shows we were not acting upon any Imperial principle at all, it was merely that the House of Commons, in its blindness and ignorance at the time, thought the Colonies were inconveniences, to be parted with. With regard to the Navy we have done equally badly more recently. Sir Thomas Brassey has alluded to the work of Sir William Jervois. No one in this room has a higher opinion of Sir William Jervois personally than I have, but he was sent out to do wrong. If you read the correspondence at the time you will see that the Australian Colonies got frightened. They wrote to the Imperial Government and asked for its advice, and there is an amusing series of telegrams, the Colonies bargaining with Sir William Jervois as to what he would go for, and how much they were to pay for his assistance. Just realize what that means. Supposing Portsmouth is found to be in an insufficient state of defence, and the people of Portsmouth bargain with

the Inspector-General of Fortifications as to his charge for coming down. Well, Sir W. Jervois went, each Colony employed him, and he gave each separate Colony advice, as if they were always to remain separate and independent of one another. Now your difficulty in dealing with Australian defence is due to that very thing. We started on a false principle, or rather on no principle, and the whole thing is in a mess. I think we have to reverse all this. You know, Sir Henry Barkly, better than anybody in this room, the whole circumstances of the Imperial defence question. You were on the Royal Commission, and you know that every sort of information was given to that Commission, and no expense was spared, but the Report of that Commission seems to have gone to a dusty old pigeon-hole, and nobody knows what has become of it; the country is not much better off than if it had never sat. I think the only way to meet the present difficulty is to let the Empire know the state its defences are in, and I would remind you of the fact—because it is a very important one—Lord Palmerston, who was in earnest about the defence of the United Kingdom, when he formed a Commission for the purposes of that defence, published every bit of evidence and every item of information it collected, showing exactly all our weakness, he published it for the whole world to see, and the result was he got the money. With regard to the general matter, I most cordially agree with Sir Thomas Brassey on the first step, and I believe the only step now to be taken, and one I have urged very often, that is to call a British Conference with Colonial representatives to examine the whole question, and I am quite sure that practical statesmen in the Colonies meeting with practical statesmen at home will be able to produce the basis of a practical arrangement, and to lay down the principles of a system under which the Empire may grow with safety, increasing its defence with the number of its growth, and in a manner suited to the wants of our Empire.

Admiral Sir ERASMUS OMMANNEY: I wish to express my very great satisfaction at the suggestion which has been made to establish a Naval College in the Colonies. What you want is to have a means by which education may be readily obtained upon maritime subjects in our distant Colonies. I therefore entirely support the suggestion which has been made. At the same time I am very much struck by the observation that we can go too far by withdrawing our Imperial forces from those Colonies. When I stood on the rock of Quebec some short time ago and asked what troops there were there, I was told there were none whatever. I believe that the Imperial force was got rid of in order to satisfy certain prejudices, but everybody agreed that an English regiment at Quebec was a sort of nucleus and would contribute very much to the formation and building up of our troops in Canada. That rock is the Gibraltar of Canada, and it is now somewhat in a defenceless condition for want of a sufficient corps of Royal Artillery and Engineers to look after the batteries and defences now going to ruin.

Sir THOMAS BRASSEY: I was very brief in the paper which I had the privilege of reading, and I know I ought to be exceedingly brief in reply, but I must say a word or two in explanation upon the points which gentlemen have referred to. My intention was to limit the action of the Colonial naval forces strictly to harbour defence, to that particular sphere of responsibility which has already been accepted by the Australian Governments, and for which they have made a certain provision in the form of floating batteries and gun-vessels; but although I contemplated that the work of the Colonial navies should be limited in the future, as now, to the sphere of harbour defence, and although it may be quite true that to man vessels intended strictly for harbour defence, a sea militia or some force of that kind suffices, yet I apprehend that for the command of sufficiently powerful vessels for the purpose of harbour defence and for the organization and training of any considerable force of sea militia or Naval Artillery Volunteers, you require a certain body of Officers with a considerable amount of training, and I endeavoured to convey the idea in the paper that the best mode of training Officers who should be placed in charge of the defence of the Australian harbours by naval means was to give them the opportunity of serving a certain number of years in the Royal Navy. If at any time we were in danger on our own coasts, or had to provide for our coast and harbour defence, I do not know to whom we should look with such confidence as to Officers trained in our own Navy, and I think the same view is applicable to

the case of the Colonies. Gentlemen have been rather critical of the suggestion that there should be a new "Britannia" established in the Colonies. It seems to me that for the purpose of educating Officers to be put in charge of the naval defence of the harbours of the Colonies a special training is extremely desirable, and I take it that the Colonial Governments will always desire that the commands of vessels which they maintain solely at their own expense for harbour defence shall be vested in themselves. Hence I conceive that it will be satisfactory to those Colonies to have some system of training for the Officers to be employed in their harbour defence. I think that a school of the character of the "Britannia" established in the Colonies would not only enter cadets for the Colonial Harbour Defence Service, but would also be a means of bringing into the Imperial Navy an increased number of youths who would be entered to go forward in the general line of service. Now I think that it would be a means of bringing about that great object which we all have in view, Imperial Federation, if we could introduce into the Navy and the Army a certain number of Officers drawn from the Colonies. I can quite imagine that there would be many cases in which parents would hesitate to part with a son of tender years, and send him for two or three years to be trained in the "Britannia," but who would willingly send a boy to a school of a similar character established nearer home. Such a school would cost nothing to the mother country. With reference to a point on which we all stand agreed, namely, this, that the defence of the highways of our own Imperial commerce must devolve upon one united Imperial force, we all recognize that sooner or later, in order that that defence shall be complete and adequate, it will be fair and proper to call upon the Australian Governments and the other wealthy Colonies to make some proportionate contribution, and I quite agree that if they are asked to make such a contribution, they are entitled when making that contribution also to make a bargain with the mother country, with regard to the amount of force to be provided. Unless there was to be an additional force provided, I would say that there should be no contribution. There is a precedent for such a bargain in the arrangement with the Indian Government, which now pays 75,000*l.* a year to the Admiralty on condition that vessels be permanently maintained in the Persian Gulf. Upon that principle these contributions might be made from the Colonies. Sir John Hay alluded to the insufficiency of the Navy. I must acknowledge to him that in one very important class of vessels I am more impressed with our necessities than formerly. I must acknowledge that I am less sanguine of the practicability of furnishing ourselves with swift cruisers for the defence of our commerce from the mercantile marine. When this question came to be practically studied on the occasion of a recent emergency, we were impressed more seriously than before with the defenceless character of the vessels which are built for the mercantile marine. They are excellent for what they are built to do, they are splendid ocean steamers, they maintain their speed in a marvellous manner in all descriptions of weather, they are great cargo and coal carriers; but when you look at them with reference to their means of resisting the effects of shot, I am bound to say that there is much that is wanting. And therefore I think it becomes more urgent to build extensively swift cruisers for the defence of our commerce. That brings us back to our point of departure, namely, to the desirability of arriving at some means by which our resources can be supplemented by contributions from the Colonies. It is a great subject, and all I can say is we never seem to have stood so well at any former time for the consideration of all these subjects in a thoroughly harmonious, patriotic, Imperial, and united spirit as we do to-day. The great service rendered by His Royal Highness the Prince of Wales in bringing about the present Exhibition cannot be spoken of in too high terms. I need not detain this meeting longer, but before I sit down I shall be glad to have the privilege of proposing a vote of thanks to Sir Henry Barkly for kindly coming and presiding to-day.

The CHAIRMAN: I am much obliged to you for the compliment you have paid me; I have done little to deserve it, but it has been a great pleasure to me to be present.

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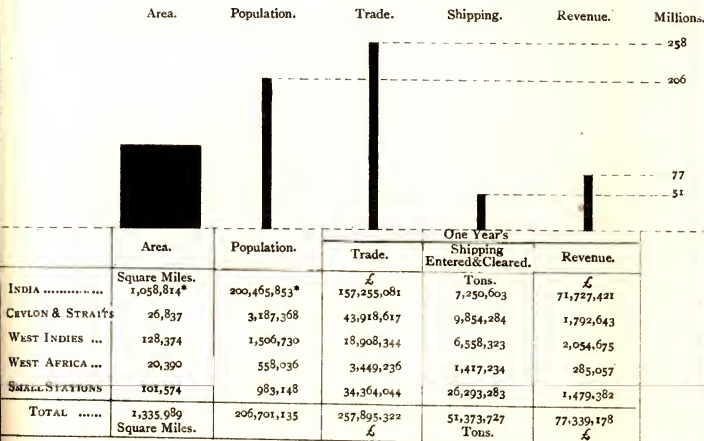
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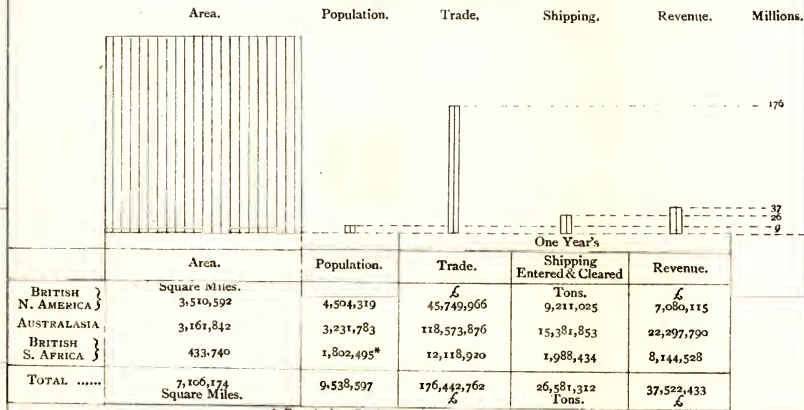
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|-------|-----------------------------|
| | Tons. |
| 2,762 | 26,581,312 |
| 5,322 | 51,373,727 |
| 8,084 | 77,955,039 |
| 3,249 | 64,272,522 |
| 7,333 | 142,227,561 Tons. |

TABLE No. 1.
DEPENDENCIES 1884-5.



* Upper Burmah included but not the Native States.

TABLE No. 2.
COLONIES 1884-5.



* Population Bechuana Land not included.

TABLE No. 3.
UNITED KINGDOM 1884-5.

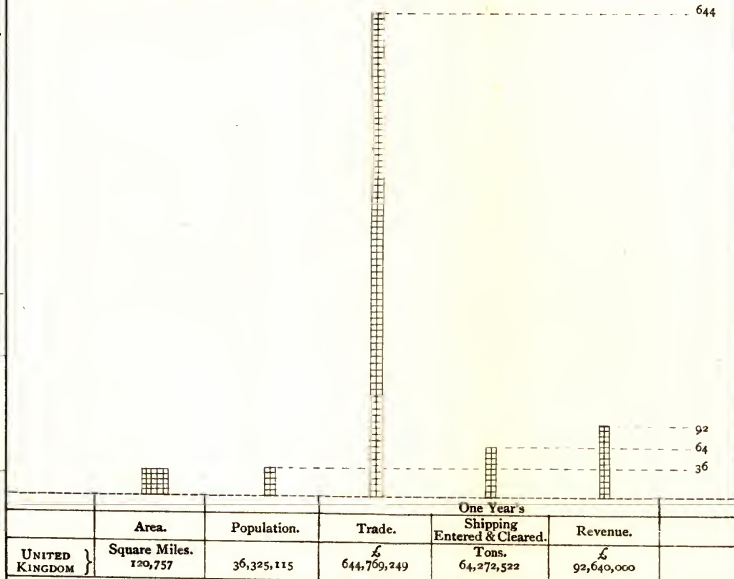


TABLE No. 4.
EMPIRE 1884-5.

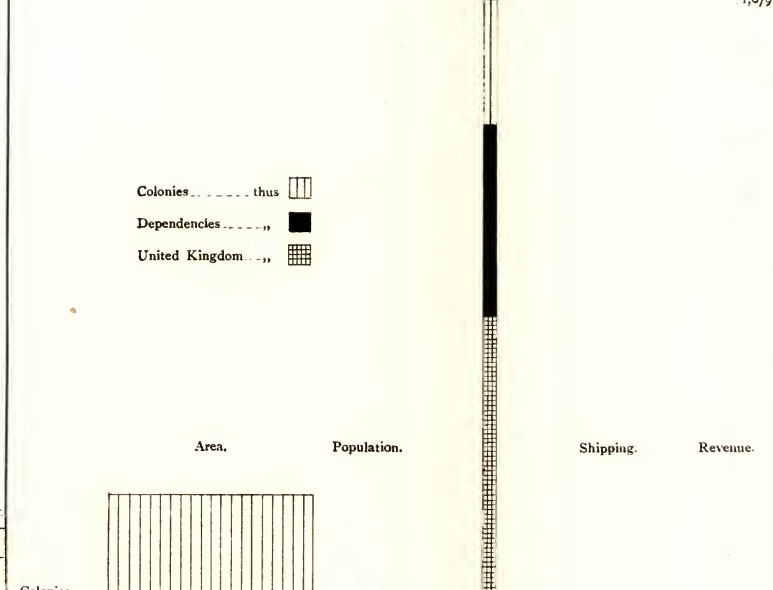
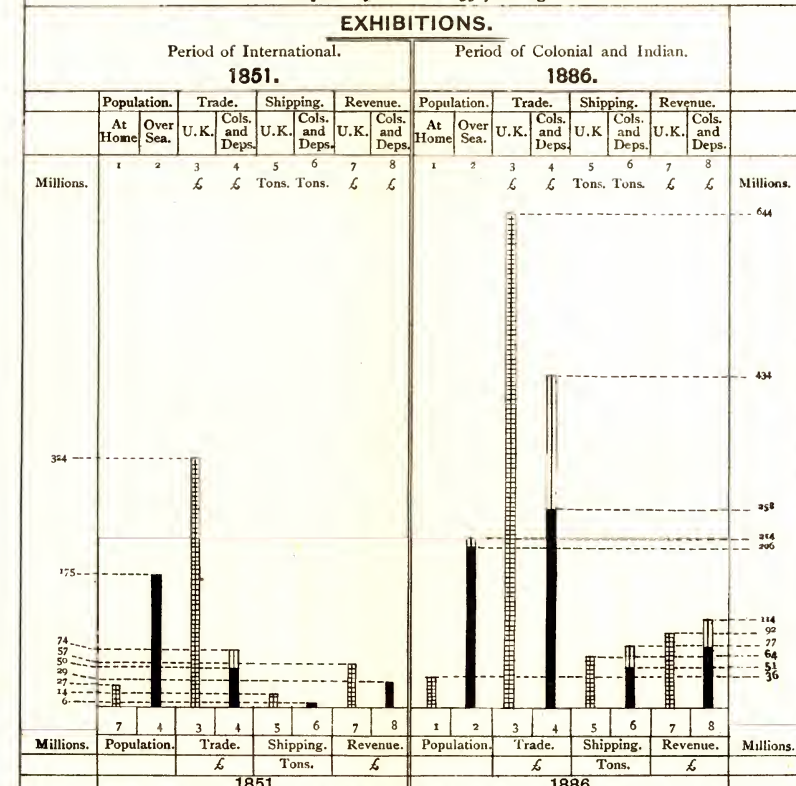


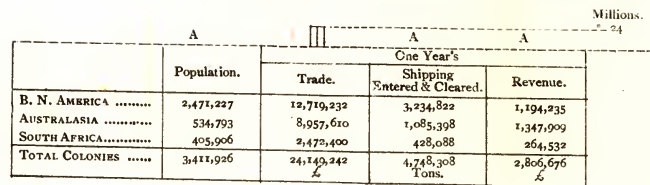
TABLE No. 6.
DIAGRAM OF GROWTH.
Population. One year's Trade, Shipping, and Revenues of the United Kingdom, and of the Empire beyond Sea. 35 years ago and now.



N.B.—The numbers at top and bottom of each figure of the Diagram are for convenience of reference. The side numbers express millions of £ in the case of Trade and Revenue; of Tons entered and cleared in the case of Shipping; and of numbers of persons under the head of Population. Six millions is the lowest figure admitting of illustration by diagram on this scale—hence, as the Population, the Tonnages, or the Revenues of the Colonies did not in their aggregate amount in either case in 1851 to six millions, they cannot be shown.

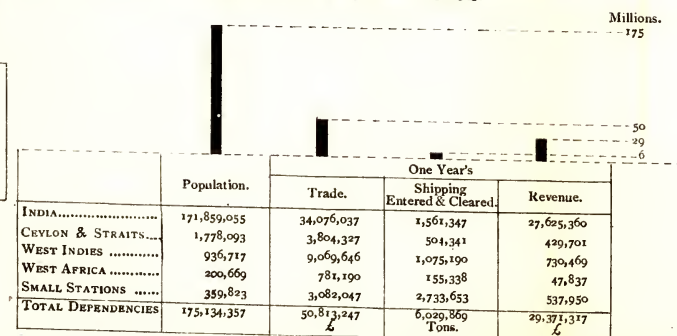
J. C. R. COLOMB.
Capt late R.M.A.

COLONIES 1851.

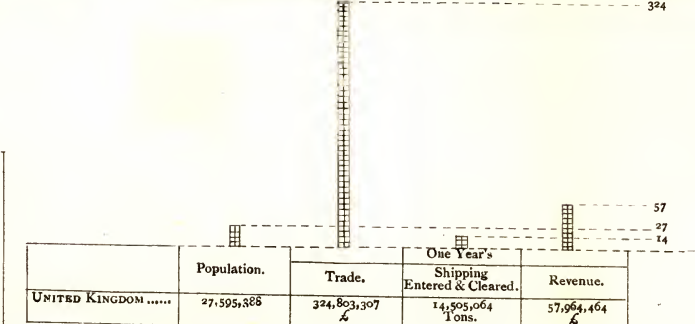


A.—As nothing less than 6,250,000 can be shown on this scale, Population, Shipping, and Revenue cannot be shown in Diagram.

TABLE No. 5.
DEPENDENCIES 1851.



UNITED KINGDOM 1851.



DIAGRAM

TABLE No. 8.

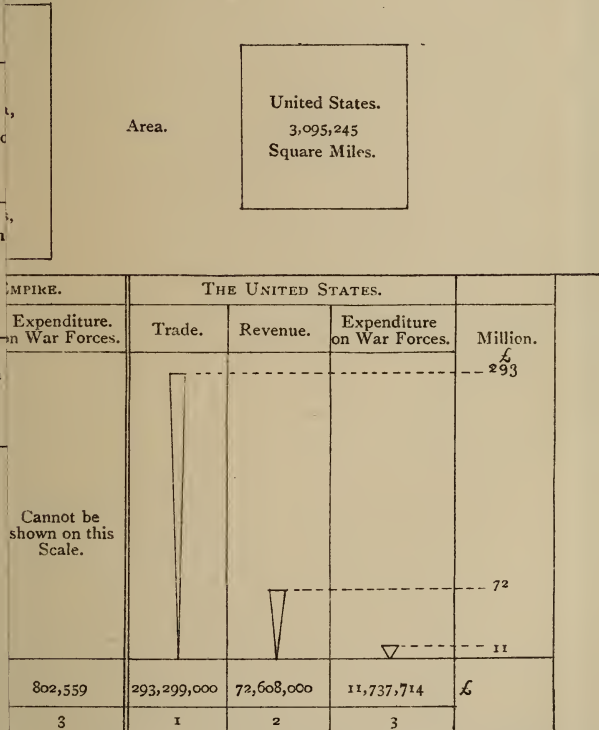
Revenue of Countries having sea boards on Pacific Ocean only.

| Revenue in Million £ | Remarks as to effective Naval power. |
|-------------------------|---------------------------------------|
| 25 | |
| 1 | Destroyed in War with Chili. |
| 7 | Sea-going modern Cruisers, etc., etc. |
| 8 | do. do. do. do. |
| 7 | do. do. do. do. |
| | Maintains no Ocean Cruisers. |

DIAGRAM

TABLE No. 9.

ual Trade ; Revenue (and the Expenditure on War Forces) of
frica, and Australasia, as compared with the United States.



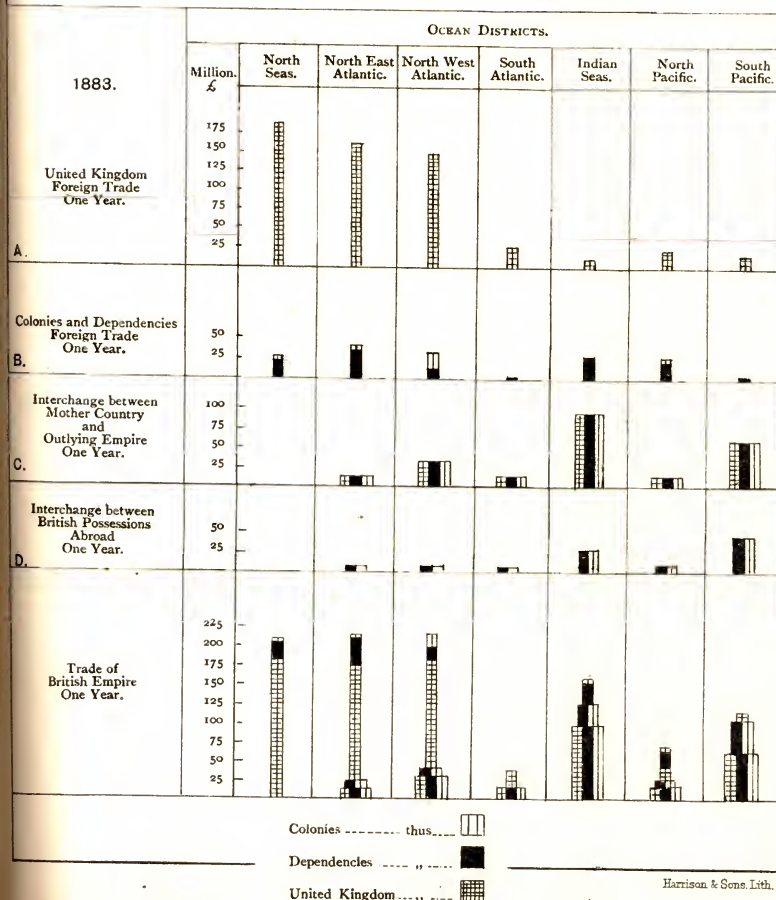
a the comparison the United Kingdom and the Empire of
dependencies, i.e., India, etc., etc.

J. C. R. COLOMB,
Capt. late R.M.A.

DIAGRAM

TABLE No. 7.

Showing by Ocean Districts the value of One Year's Trade of the British Empire—distinguishing between Foreign Trade of the United Kingdom—the Foreign Trade of the Colonies and Dependencies—the interchange between the Mother Country and the outlying Empire—and also the interchange between British Possessions abroad.—1883.



DIAGRAM

TABLE No. 8.

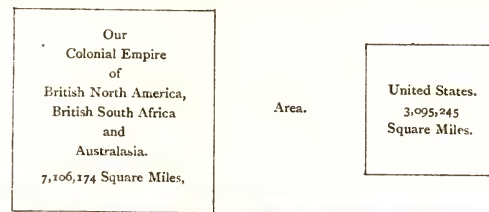
Comparing the Trade and Revenue of Countries having sea boards on Pacific Ocean only.

| | Trade in Million £ | | | Revenue in Million £ | Remarks as to effective Naval power. |
|------------------|--------------------|----|-----|----------------------|---|
| | 25 | 50 | 100 | 25 | |
| Peru..... | | | | | Destroyed in War with Chili. |
| Japan..... | | | | | 7 Sea-going modern Cruisers, etc., etc. |
| Chili..... | | | | | 8 do. do. do. do. |
| China..... | | | | | 7 do. do. do. do. |
| Australasia..... | | | | | Maintains no Ocean Cruisers. |

DIAGRAM

TABLE No. 9.

Showing aggregate of Area; the Annual Trade; Revenue (and the Expenditure on War Forces) of British North America, South Africa, and Australasia, as compared with the United States.



| Million. £ | OUR COLONIAL EMPIRE. | | | THE UNITED STATES. | | | Million. £ |
|---------------|----------------------|----------|----------------------------|--------------------|------------|----------------------------|------------|
| | Trade. | Revenue. | Expenditure on War Forces. | Trade. | Revenue. | Expenditure on War Forces. | |
| 176 | | | | | | | 293 |
| 37 | | | | | | | 72 |
| 11 | | | | | | | 11 |
| £ 176,442,762 | 37,422,433 | 802,559 | 293,299,000 | 72,608,000 | 11,737,714 | £ | |
| 1 | 2 | 3 | 1 | 2 | 3 | | |

N.B.—This Diagram excludes from the comparison the United Kingdom and the Empire of Dependencies, *i.e.*, India, etc., etc.

J. C. R. COLOMB,
Capt. late R.M.A.

EMPIRE

ION, NAVAL & MILITARY.

Plate XXI.



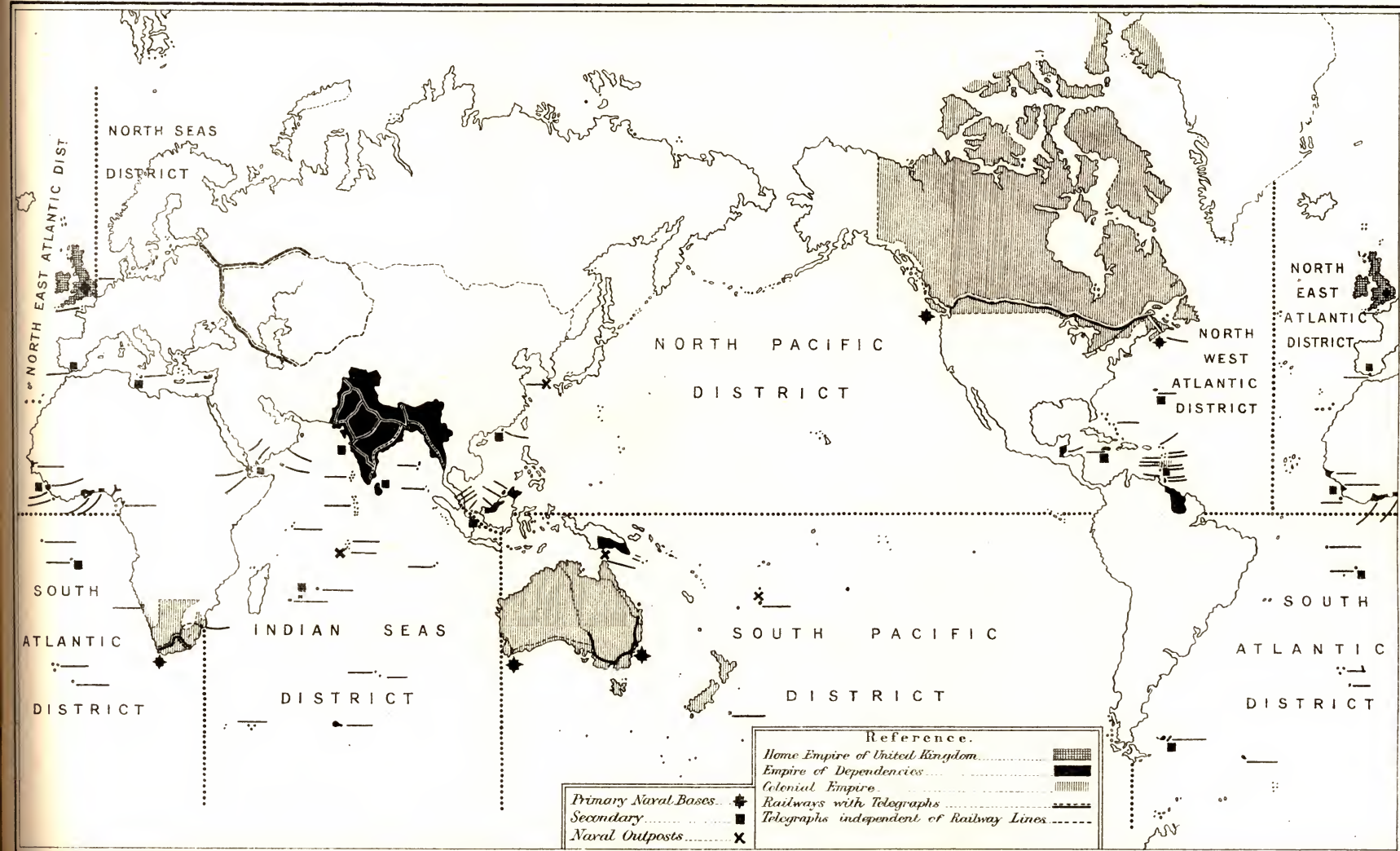
STRATEGICAL SKETCH OF THE BRITISH EMPIRE

TO ACCOMPANY LECTURE & DIAGRAMS ON IMPERIAL FEDERATION, NAVAL & MILITARY.

Journal R.U.S. Institution.
Vol. 30.

by J. C.R. Colomb, formerly Capt. R.M.A.

Plate XXI.



Wednesday, June 30, 1886.

THE RIGHT HON. THE EARL OF CARNARVON, some time Secretary of State for the Colonies, and Chairman of the Royal Commission on Defence of Ports and Coaling Stations abroad, in the Chair.

IMPERIAL FEDERATION.

What we,—the advocates of Imperial Federation,—aim at is the closer Political Union of all the Dominions of the Queen of Great Britain and Ireland.

By Colonel Sir CHARLES H. NUGENT, K.C.B., late R.E.

RUSKIN opens his work on the “Stones of Venice,” by setting up for comparison three States, which have risen to eminence above all others by the dominion asserted by their children over the ocean, Tyre, Venice, England, and, says he, of Tyre, only the memory remains,—of Venice, only the ruin,—of England, which inherits (?) their greatness, that if it forget their example, it may be led through prouder eminence to less pitied destruction. Suggestive of serious reflection as this passage must ever be to English readers, it is most suggestive, to me at least, when in his farther description of the State of Venice, I reach that paragraph which describes how an agitated democracy developed into an elective monarchy, gradually limited and shortened of its prerogatives, while increasing in spectral and incapable magnificence, until in the final government of the nobles under the *image* of a king, Venice reaped the fruit of her former energies, consumed them, and expired.

To some memories will no doubt recur the words in which a poet of this century, standing by her still and death-like waters, depicts her past glories, while describing the present condition of Venice:—

True her high spirit is at rest,
And all her days of glory gone,
When the world's waters, east and west,
Beneath her white-winged commerce shone,
When with her numerous barks she went
To meet the Orient Empire's might,
And her Giustinianis sent
Their hundred heroes to the fight.

And the scathing denunciation with which he leaves her:—

Mourn not for Venice, though her fall
Be awful, as if Ocean's wave
Swept o'er her; she deserved it all,
And Justice triumphs o'er her grave.

Thus perish every king and state
Which runs the guilty race she ran!
Strong but in ill, and only great
In outrage against God and man.

MOORE (*from memory*).

Amidst the enthusiasm, chivalry, or fanaticism of the other States of Europe, Venice was roused to action only by the touch of a secret spring, that spring was her commercial interest, the one motive of all her important political acts or enduring national animosities; she calculated the glory of her conquests by their value, and estimated their justice by their facility.

To the thinking mind which endeavours to forecast the course of the future by the teachings of the past, there is something eminently suggestive in this description, and I find myself constantly asking myself the questions, Are we such as Venice was? Shall we, too, end like Venice?

Time would not avail me to show how much of the resemblance between England and Venice is seeming and superficial; how much, how *very much*, is due to the masterly touches which the great word-painter, in his absorbing devotion to his art, puts in to give form to the whole, and to complete his picture in accordance with his own ideal.

There is, however, one most weighty consideration to which Ruskin does not—at any rate does not seem to—assign its due share in the rise and fall of Venice, and its due share in the present position of England, and that is, in each case, the *genius of the nation*. We may be unable to say to what the differences of national genius may be due, but we can at least say that they are in part due to physical influences, such as situation, climate, and soil (Cunningham, “Policies and Economies,” p. 135). And herein I find much ground for satisfactory reflection; in these three most essential conditions Nature has so highly favoured England.

No doubt it may be said that the tendency of national genius has been in the case of each to the acquisition of national wealth; but the question what is national wealth will receive a very different answer at different times, and in different countries. We need not stop to inquire what was the Venetian conception of national wealth, but this much we may assert, that it was very different from the present English conception of national wealth, the function of which may be stated as the maintenance of life, the maintenance of as noble a life as may be, and for this a most important requisite is a vigorous and skilful population. Industry is the true source of wealth;—our Colonial Empire, as well as experience within our own land, confirms the truth that a vigorous and industrious population is the true source of wealth. You will find, if you pursue this subject, that health, skill, and moral character are necessary elements if the national life is to be sustained and *prolonged*; it was in this necessity for *prolongation* that Venice fell short; she did not comprehend that national wealth consists of all physical objects, which have not only to sustain, but to *prolong* the national life.

It is the pursuit of this national wealth which has raised this country to the pinnacle of eminence upon which she stands; it is the energy and industry of her sons which have enabled her to outstrip all rivals, and in doing so have placed the carrying trade of the world in her hands. This is a wonderful position, but in the achievement of this position the whole condition of things in England has changed;

the population has increased enormously, but the land no longer supports this population to the extent it did; the average mode of living has risen to a higher standard, and the average cost of living has risen with it, and it has come to pass that many of the necessities of life can be raised at a far less cost in other and far distant countries, where labour is perhaps not half the price it is here: can not only be raised, but be raised and carried to this country, and here sold at prices with which the English agriculturalist finds himself in many cases unable to compete.

You can form some idea of this when I tell you that the British imports exceed the exports by 187,092,106*l.* :—

United Kingdom.

| | |
|--------------|--------------|
| Imports..... | £426,891,579 |
| Exports..... | 239,799,473 |
| | <hr/> |
| | £666,691,052 |

and that upwards of 100 millions of the imports are for foodstuffs, meat, animals, grain, flour, and vegetables. Now in this respect our position in Europe is, and not in Europe only but in the world, almost unique. With the exception of France and Italy, all the other great nations of Europe are self-supporting; and in France the imports are to the exports as 231 millions to 182 millions :—

| | Imports. Millions. | | Exports. Millions. |
|---------------------|-----------------------|----|-----------------------|
| Germany | 164 | to | 166 |
| Russia | 130 | | 129 |
| Italy | 52 | | 47 |
| Austria..... | 29 | | 34 |
| Spain | 33 | | 34 |
| United States | 115 | | 148 |

But we depend upon foreign countries for more than half our food supply; thus we import 1 lb. of wheat or flour daily, and $\frac{1}{4}$ lb. of meat daily,—per head of the population,—to say nothing of tea, wine, and spirits.

Competent authorities estimate that by 1891 the population of these islands will have risen to 40,000,000, an increase in the intervening five years of 3,600,000; then still less will the land support the population, and the imports of food, which now amount to 2*l.* 15*s.* per head, will probably be not less than 4*l.* per head. 2*l.* 15*s.* appears to be an abnormally low figure; the year preceding it was 3*l.* 9*s.* per head.

In the changed conditions of labour, owing to which the agricultural population is being gradually withdrawn from the land to overpeople the manufacturing cities, the health of a large section of the nation suffers prejudice: it is true that the tables of mortality show progressive increase in the duration of life, but this increase cannot

be the rule for a large section of the manufacturing class. In skill we have improved, I believe, upon our predecessors. In moral character—well, it is difficult to speak with certainty respecting this element of the national life. In reflecting upon it, it occurs to me sometimes that we are no worse than our predecessors, but certainly it never occurs to me that we are better. Nevertheless, I believe that the bulk of the nation, especially in the middle and lower classes, is sound at heart.

Yet in spite of this, the present state of things in this country is very unsatisfactory,—indeed the present is a serious crisis in the national life. Trade is depressed, capital is idle, production, overstimulated here and in other countries also, is restricted, distribution is contracted, and a great number of men are without employment; the whole world seems to be suffering from want of markets. Some advanced thinkers have arrived at the conclusion that this will recur periodically,—that, with the facilities for intercommunication, by which the wants of one people are brought within reach (to the very doors) of another, the competition will be so keen, that the tendency of supply will be to exceed the demand, and that the markets of the world will be always swelling up to the point of repletion.

If the state of things be so with us now,—what will it be five years hence when four millions are added to the population? What will it be when we are engaged in an European war?

I have already told you that we depend upon foreign countries for half our supply of food, but if this supply were suddenly cut off, what would become of us? And it might be cut off,—the operation would not be very difficult,—for this supply of food comes from long distances—from America, from India, from Russia, from Australia—and passes within striking distance of countries envious if not unfriendly, and which may at any moment become hostile.

But in considering this matter of striking distances our view should not be restricted to Europe; Russia is an Asiatic as well as an European Power,—indeed it is as an Asiatic Power that she should be a source of anxiety to us,—as I have pointed out on previous occasions here, the Naval and Military Establishments which she has formed and is perfecting in the Pacific, seem scarcely called for by the circumstances of her Empire in that Ocean, and are well placed for offensive operations against Australia, England, and the seaboard of our Indian Possessions.

Conversely, how infinitely stronger becomes our position in India, with a wealthy, contented, and United England in Australia.

Nor is it to Russia only that we should look in Asia. China, with its enormous population and its distinctive civilization, which, while it parts its children from amalgamation with Western races, does not preclude the assimilation of Western ideas, and the adoption of Western military methods, must be a cause of anxiety to our kinsfolk in Australia,—even when China is confined within the limits of her own territories,—and must be still more so when her children flow over the islands and shores of the Pacific.

Japan, too, though smaller, manifests similar tendencies, but to a

higher degree, and must claim attention. These two nations, even if not formidable in themselves, may readily become so under European leaders, and many of our difficulties in the East have been due to Native Troops led by Europeans. The Chinese under a second Gordon would be formidable adversaries.

The lessons of the past will have been in vain for us if we lose sight of the part played by France in the War of Independence. France, while at peace with England, assisted America for two years, and indeed virtually fought the War of Independence. The France of that day is the France of to-day, and will remain so,—as long as France is France and England is England. So also Holland, while at peace with England, was actively assisting the Americans for two years before England declared war with her.

Defence is in reality the Prime Factor in all Federations. I am aware that this matter of Defence is sometimes deliberately put aside, under the apprehension that the cost involved in it may frighten the lukewarm into opposition, but I venture to think that this apprehension is misplaced, and that our kinsfolk beyond the sea are more able individually, and quite as willing as we are, to take their share of the cost.

In previous papers read before this Institution, I have shown that the measures necessary for safeguarding our commerce, and of course in it our food supplies, are neither very difficult nor inordinately costly. Captain Colomb has fully placed the military aspects of Imperial Federation before this Institution, in his paper read here on the 30th ultimo, and I will content myself by merely indicating what measures are necessary. Stated in the most general terms they are: thoroughly defended ports and arsenals at home; thoroughly defended ports and naval arsenals at carefully chosen places abroad; intermediate refitting stations, nearly all of which are already in our hands, also thoroughly defended; efficient and strong patrols maintained on the well-defined passing places, where the Ocean Trade Routes converge, and which are not many in either hemisphere.

One thing is certain, that if this food supply were cut off, we could not revert to old economic conditions; we could not fall back upon agriculture, the land in this country will never again support the people. Possibly, though I am unable to see in what direction the possibility lies, an altered economic condition may develop itself to meet the altered circumstances of the case.

If this food supply were cut off, we should drag on, well, perhaps for six weeks! and then if we fought our way through, as I cannot doubt we should, we should have lost perhaps for ever a large portion of our carrying trade, which is literally the bread of our national life.

People do not sufficiently realize the vital importance to us of this carrying trade, indeed, they cannot do so unless their attention is directed to it; the total reaches the vast sum of upwards of 1,000 millions per annum, and the profits which the country realizes upon this must be very large;—it finds employment for 220,000 sailors, not all British sailors to be sure; a cessation of trade then would,

amongst other evils, mean 200,000 men lying idle and demanding food. Ships representing 74,000,000*l.* capital out of employ, and at least 70,000,000*l.* trading capital unable to earn income, the result would be fearful to contemplate, and I cannot doubt, to use a historic phrase, that we should be within measurable distance of revolution, and perhaps of anarchy.¹

Some will no doubt say that this danger is not great, and at any rate may be easily exaggerated; it is not my wish to exaggerate; no good is got by exaggeration. If we have avoided the danger hitherto it is rather because we are strong, wealthy, and resolute, but strength is after all a question of numbers, and England, more densely populated than the great European nations, is less capable of expansion than they are. Yet even as it is have we no rivals? We hold our place by great exertion, and look what efforts Germany is making with her already larger population of 45 millions, to gain a share in the carrying trade of the world,²—the vast sums she has spent or is spending on her two fortified ports of Kiel and Wilhelms-hafen,—the money she contemplates spending on the ship-canal across the neck of the Jutland Peninsula, by which the Baltic will be united to the North Sea; her measures, which do not always commend themselves to our ideas, for planting Colonies: her policy of State subsidies to all the large lines of steamers which trade to these Colonies,—all point to a steadfast pursuit of, if not the Empire of the Ocean, at least a share in the commerce moving over the waters, and recollect these Germans are good colonists, possessed of many admirable qualities, thrifty, manly, and persevering; already considerable success has attended their efforts in Europe, and English goods are in many places being thrust out by German goods.

“Von Hubner says the Germans prosper here (Fiji) as in all other parts of the globe wherever they settle. Their activity, their intelligence, their spirit of economy and their sobriety are warmly praised. They are strangers alike to luxury and any form of extravagance.”—(Brit. Emp., vol. ii, p. 294.)

Travelling last autumn in Denmark, I was much impressed by the observations of a Dane with whom I fell into company; he remarked to me how their country was being flooded by inferior German cloths. He said that his countrymen were very constant in the use of broad cloths, and of the same description of cloth, that they had been in the habit for generations of getting such from England, but that the Germans had pushed in of late, and by dint of perpetual touting were securing the market, though, added he, if the English took the same pains, the Danes would not look at German cloths; but the English were too proud to tout for small orders, and so “they are losing our trade because they do not think it worth pushing for; the

¹ 150,000,000*l.* idle, represent a loss of say 10,000,000*l.* of income, and cost of feeding 200,000 idlers 5,000,000*l.* more, a total annual loss of 15,000,000*l.*

² Between 1874 and 1883 the exports from Germany to the United Kingdom rose from 20,000,000*l.* to 28,000,000*l.*, while the imports to Germany from the United Kingdom fell from 24,750,000*l.* to 18,750,000*l.*: that is, in the nine years Germany gave us 8,000,000*l.* more, and took from us 6,000,000*l.* less.

fact is the German will strive for a penny in a way an Englishman will not for a shilling"—I don't think the Englishman is the wiser.

This matter of numbers being of such importance, no Englishman can notice without concern the tendency of peoples to empire themselves in great nationalities,¹ this process of the absorption of the smaller by the greater has been going on steadily throughout the past century. Cast a handful of globules of quicksilver upon a smooth dish, agitate the dish slowly and you will see the smaller globules uniting to form larger,—the smaller globules still left falling into the nearer larger,—until, as the movement proceeds, only one mass remains. This is the process going on throughout Europe, the larger communities are steadily absorbing the smaller; look what has happened in Poland, in Finland, in the smaller States of Germany, in Savoy, in Schleswig-Holstein, in Alsace and Lorraine, and in Montenegro. Consider what may happen in the case of Holland, of Belgium, of Denmark, of Portugal: it does not need a far-seeing eye to forecast the period when the Continent of Europe shall be apportioned between Slavonic, Teutonic, Latin, and Greek nations.

When this happens, what shall be our position? The population of these islands will be insignificant in numbers beside the magnitudes of these nations. If our Empire be then limited to these four seas, we shall be indeed insignificant, the Holland of that day with our carrying trade departed, leading the existence of sufferance only. Is such an existence worth leading? Every man must answer this as his feeling prompts, but for myself I have no hesitation in saying, better that this country should be whelmed beneath the ocean than that that day should dawn upon it.

How are we to avoid such a future? And again the question I put to myself at starting rises within me: How are we to avoid the fate of Venice? My answer is, *by Federation*, for it seems to me—and the more I reflect upon it the more certain it seems to me—that our future rests upon the consolidation of a Greater Britain, by cementing into Federal union with us our Provinces beyond the seas.

The population of these Provinces already exceeds 10 millions of Englishmen. In these Provinces, which are of enormous area, is unlimited room for expansion, and by the time the population of the United Kingdom reaches the total of 50 millions, the population of these Provinces will be as many more,—in about fifty years according to Seeley.

¹ *Standing Armies.*

| | Peace. | War. |
|---------------------|----------------------|------------------------|
| Great Britain | 239,000 ^a | 559,000 |
| France | 524,497 | 2,500,000 |
| Germany | 445,392 | 1,535,400 ^b |
| Russia | 550,538 | 1,010,601 ^c |
| Italy | 750,765 | 1,021,954 |
| Austria | 272,400 | 1,039,586 |

^a, includes 44,000 Reserve.

^b, without Landsturm, and 14 cadres, 11,000,000 additional!

^c, without Territorial Army and Reserve, 1,876,353 additional.

People do not sufficiently realize this capacity for expansion, it is one of the most marked features of these new worlds. Forty years ago my service carried me to North America; at that time the feeling of the Americans (I should say here that the inhabitants of the United States admit no others to be Americans) was distinctly unfriendly to us; rebellions in Canada in which American sympathizers had taken active part had not long been suppressed, and the question uppermost in men's mind was: would the States some day annex Canada? I confess that I was constantly filled with gloomy forebodings as to the issue of the rivalry between the two countries. England was so heavily handicapped, the sense of freedom of power of expansion seemed to afford the dwellers across the Atlantic more space for breathing, to invest them with a more vigorous type of life, to endue them with more independence; so that on my return after a prolonged absence, much as I found to admire in the movement and improvement in England, it was long before I could rid myself of an oppressive feeling of want of *elbow-room*.

This has been noticed by Von Hubner, who says of the Americans: "You feel you have to do with people who are open-handed, and who give you plenty of *elbow-room*."

To use Seeley's words, "In the Colonies are lands for the landless; prosperity and wealth for those in straitened circumstances; on the one side are men without property, on the other is property waiting for the men; if there is pauperism in Wiltshire and Dorsetshire, it is but complementary to unowned wealth in Australia." Who shall deny that we ought to strain every nerve to draw the Colonies closer to us? Federation will so materially help us in point of numbers, and numbers are strength, and especially strength in war—you know the old saying that Providence is on the side of the strongest battalions—but Federation will do more than this, it will afford an outlet for our redundant population, an outlet through which they will pass, not to go out from us for ever, but to gather fresh vitality and energy with which to come back to us in our time of need;¹ for in these Territories is room and to spare for all to live, and, if thrifty, to prosper; will open to us favourable markets, and will lay open to us lands of fertility from which we may draw without stint all the food supplies of which we stand so urgently in need.

But those who are not with us object that Federation, however desirable, is not feasible for us under the diverse conditions of soil and climate which obtain in our Colonies, and at their enormous distances from us. Let me at once deal with this matter of distance; distance is no bar, steam and electricity have done so much for us already, and their limits of power are not yet reached, that political union over these vast expanses of water is even closer and more certain than the union of 80 millions of Russians scattered over a territory, entirely land, of 2 million square miles; militarily too, the sea,

¹ The Colonies have ever shown this feeling—going further back than the late war, before the American Colonies were forced into separation, we find them saying, that in peace they cost Great Britain nothing; in war they contributed to the Imperial expenses, and would *continue to contribute*.—(Froude, vol. ii, p. 136.)

as we are able to put it to our use, is the best Line of Communication that Captain can desire.

It is recorded that when Cromwell assumed the Protectorate, the news was thirteen or sixteen days in reaching Devonshire. In sixteen days in this year of Grace you may go to America and back; in sixteen days the Home and Australian Fleets might concentrate in the neighbourhood of Suez. So much for distance. Distance was no bar to Cromwell; why need it be to us, who can by telegraph communicate almost instantaneously our wishes to the Antipodes?

The landing of William in Torbay in November, 1688, was not known in Shetland till the following May; but there was no regular post from Edinburgh even to as far north as Inverness until the Union in 1707, and for fifty years after that it was carried on foot (Lecky, England in the Eighteenth Century, vol. ii, p. 28).

And now for climate and soil. Climate and soil do not altogether fashion men's interests, though no doubt they play their part in shaping them. Attachment to the old country, which we still call patriotism; respect for law, upon which we rest our freedom; regard for domestic ties, which is our ideal of social duty; and the habit of manly self-reliance, upon which we justly pride ourselves, are not altered, are not even lessened by climate. As I write, Ingoldsby's clever rhyme upon the old Latin verse rises in my memory—

“Cælum non animum mutant qui currunt transmare.”

“Climates, not men's minds, by travelling vary.”

What have we further to encourage us in starting upon this course of Federation? We have Community of Race, Community of Language, Community of Religion, and we have primarily Community of Interests, though of course as time rolls on, local matters become of more absorbing interest than more distant matters; but however these interests may tend more and more apart, we have at least this strong interest in common—the interest for maintaining the connection between us.

Von Hubner remarks, “Much more is thought of the interests which separate the Colonies than of those which they share in common and which ought to unite them” (Through British Empire, vol. ii, p. 494).

What are the objects of Federation? Defence, External Policy, Extension of Territory, International Communication, Regulation of Commerce, Prosecution of Justice, Extradition of Criminals, Patent and Copy Rights.

Should the “Obligation of Contracts” be included? than which Maine says there is no more important point in the whole (American) Constitution; it is the bulwark of American individualism against Democratic impatience and Socialistic fantasy.

But again the objectors who ask “What is the good of Federation?” say, You have already got all these things—got in fact all that you want; the loose tie which binds our Colonies to us is sufficient—is indeed eminently suited to the disposition of the British people. *Let it alone.* The answer is, The Union we have is an Union of Sufferance,

and we cannot place absolute dependence upon sufferance. It is an Union of Sentiment, and we would place ourselves out of the reach of sentiment, believing that sentiment affords opportunity for caprice, as well as scope for the infirmity of Imperial Officials,¹ who seem not always chosen for their knowledge of the Colonies, and perhaps not unfrequently in requital of party services. It is an Union without responsibility,² and wanting in cohesion: moreover, the position is galling to educated Colonists, and the system is utterly irrational, if we can call that a system which grants representative institutions to one class of interests and withholds them from another.

Turned aside from this, they next object that Federation in our case is not feasible, and taking their stand upon the word which we have wisely or unwisely adopted, that there can be no such thing as *Imperial Federation*—that the course which we are pursuing will lead us to Sovereignty or Unitarianism, or, failing these, to disintegration. Moreover, they say that in the natural course of things the Colonies, as they arrive at men's estate, will separate from the Mother Country as ripe fruit falls from the tree; and they point, not without inward satisfaction perhaps, to the United States, which they consider a case in point.

At the time the American Colonies separated from the Mother Country the state of things was very different from what it is now. Colonies were regarded as *possessions*, not as parts of the Empire of England—as estates to be worked for the benefit of those Englishmen who remained at home. Thus Froude says: "The lesson especially the Mother Country had never ceased to impress upon the Colonies, that they existed not for their own sakes but for her; she regarded them as created by herself,—as outlets for her own productions; they were strictly forbidden to trade with any countries but England or Ireland, or to ship their cargoes in any but English ships." On the one side was a King, almost alien, who, however little he cared for Hanover, and however much for governing England, understood and perhaps cared really very little for English interests at home, and still less for English interests abroad—a King³ who was unwilling to concede any

¹ Thus "Imperial Federation," speaking of Lord Granville and Mr. Osborne Morgan as the new Secretary and Under-Secretary of State for the Colonies, says of the former, he was Foreign Minister at the time the unfortunate arrangements for New Guinea and Angra Pequena were made; of the latter that he is chiefly known to the public through his connection with the Burial Bills, but the real grievance is that not a Colony throughout the world would have conceived the idea of nominating either Lord Granville or Mr. Morgan for his present post.—(No. 3, p. 69.)

² Responsibility must rest with supremacy. Where at present is the supremacy? In the British Parliament? Dare the British Parliament exercise it upon any self-governing Colony? You know it dares not, and if it did you can foresee the result. Von Hubner says, "I can see only one contingency in which the loyalty of a Colony might completely vanish, viz., a complete negative to some cherished aspiration of Public opinion."—(Vol. ii, p. 499.)

³ The King upon his side did his utmost to embitter the contest. It is only by examining his correspondence with Lord North that we fully realize how completely at this time he assumed the position not only of Prime Minister but of a Cabinet. Military management, the course of the war, the manner in which Government ques-

but a mere dependent *locus standi* in national matters to the Colonies, was unwilling even to admit that they could have interests apart from or which might conflict with home interests, and yet who, alien as he was, was able to impose his bigoted, narrow, anti-national will on the dull pedantic Ministers who served him.¹

On the other side were the Colonies, no longer finding it necessary to look to England for defence, harassed vexatiously and injuriously by England's commercial policy, which was directed to a monopoly of the Colonial trade, and was indeed the prime cause of the disruption,² having little or no part in English social matters, apprehensive of being dragged after England into Continental matters, which were of no immediate concern to them, resenting being taxed in the interests of those who professed to be their brothers, and yet treated them as if they were a conquered people.³ Add to this, too, that they were not Colonists in our present sense of the word; they were not the overflow of the Mother Country; they were religious communities⁴ which committed themselves to the dangers of the unknown ocean in order to exercise beyond its troubled waters those rites of religion the free practice of which was proscribed to them at home. What wonder, then, they burst the ties which held them,—and galled them while they held them,—and severed the connection with the Mother Country?⁵

tions were to be argued in Parliament were prescribed by him, and Ministers acted simply as his agents and in direct opposition to their own judgments.—(Lecky, vol. iv, p. 471.)

¹ It appears from the correspondence that for about five years North at the entreaty of the King carried on a bloody, costly, and disastrous war in direct opposition to his own judgment and wishes.

Lord Barrington, who was Minister of War, disapproved of the policy of coercing the Colonies; believed the military enterprises he organized would lead to nothing but disaster, that the Americans might be reduced by the Fleet, but could never be by the Army, and yet obediently carried out the King's plan for the Government.—(Lecky, vol. iv, p. 471.)

² As early as 1748 the Swedish traveller Kalm was told that within 30 or 40 years the English Colonies may constitute a separate State, independent of England—these dangerous neighbours (the French) is the reason why the love of the Colonies for England does not wholly decline.—(Lecky, vol. ii.)

³ As early as 1776 Turgot wrote: "Wise and happy will be that nation which shall first know how to bend to new circumstances, and consent to see in its Colonies allies not subjects."

⁴ 20,000 Protestants left Ulster on the destruction of the woollen trade. Many more were driven away by the first passing of the Test Act, and in the loss of independence, England had no fiercer enemies than the descendants of these . . . Presbyterians, Puritans, Independents, in search of wider breathing space than was allowed them at home . . . Vexed with suits in the Ecclesiastical Courts, forbidden to educate their children in their own faith, treated as dangerous to the State which but for them would have had no existence, associated with Papists in an Act of Parliament which deprived them of their civil rights, they saw at last that the Liberty for which they and their fathers had fought was not to be theirs in Ireland.—(Froude, vol. i, pp. 268, 391; and vol. ii, pp. 130, 132.)

⁵ The King was never what we should call a really Constitutional King—his own words, which are too clear for cavil or dispute, prove this. He said that "no advantage to *this* country, no present danger to *myself*, can ever make me address myself to Lord Chatham or any other member of the Opposition." The King adopted the same line later, in 1804, with respect to Fox, and in March, 1782, when Lord North's Ministry came to an end, it is said he contemplated abdication and return to Hanover.

If we drift as we are now drifting, we shall no doubt arrive at disintegration, but disintegration will not be our goal, will be only the first stage on the road to *national effacement*. Now we, the advocates of Federation, have no intention of travelling on that road, and that is why I am here to advocate an Union, under the name of *Imperial Federation*, upon which we can rely in the future.

But supposing the course we are pursuing does lead to *Unitarianism*. Myself, though I prefer a more orthodox Federation, I have no antipathy to this *Unitarianism* (the habitual exercise of supreme legislative authority by one central power, which in our case is the British Parliament—Dicey, *Law and Constitution*, p. 127), by which I understand that somewhere in our Constitution there is an ultimate point of supreme authority or Sovereignty. *Unitarianism* has served us so well, seems so well suited to the genius of the Nation, that we may expect it to suit our offspring equally well, especially as the Constitutions under which they flourish are all based upon this underlying principle, that the ultimate authority is the expression of the influence of the citizens upon the State—is indeed the outcome of the force of Public Opinion.

It may be urged that this *Unitarianism* answers our purpose so well here in Great Britain, because the unit, the directing authority, is so immediately with us, is *we ourselves*, we, by our influence on the State, we, who are the Public Opinion, but that it will not subserve the same purpose, or at least to the same extent, in influencing and moulding the integral parts of Governments so distant from us as the Colonies, or rather of the Empire as a whole comprising the Colonies. If that be so, though it is open to doubt, let us get rid of the Unitarian principle, and adopt any other form of Federation,—or Union,—by whichever name you call it, which we may find more suitable. There is no one and only specific for Federation. The United States is generally referred to as the most perfect type, but it is by no means perfect,¹ and there are other and very different types, as the Dominion of Canada and the Republic of Switzerland.

Of the United States, Bagehot says of the Electoral College which the founders of its Constitution hoped would be composed of the wisest people in the nation, that “it is a sham without independence and without life,—no one knows or cares to know who its members are; they never discuss; they never deliberate; they are chosen to vote for a particular man, they do so vote, and they go home.” “So President-making is a trade in America;”—“International Policy rests not with the President,—not with the House of Representatives, but in the Senate;”—“The President wants one course and has power to prevent any other;—The Congress wants another course and has power to prevent any other.”—(Expan. Eng., pp. 153, 222, and 256.)

A very large and increasing body in all the Colonies is desirous of

¹ The Constitution of the United States is coloured throughout by political ideas of British origin, and is in reality a vision of the British Constitution as it must have presented itself to an observer in the second half of the last century.—(Maine's *Popular Government*, p. 207.)

a closer connection with the Mother Country, by whatever name that connection is called, and leagues have already been formed in most of the principal Colonies, and in many of our principal towns, but as a member of the New Zealand Legislature remarked in discussing the prospects of Imperial Federation, "Our great difficulty really is the want of the Imperial idea in the British isles, they have got into such a way of looking upon themselves as the Empire, that they have not yet awoke to the fact that there is a Greater Britain outside of Old England." No doubt this problem has difficulties of its own, immense difficulties, but the greatest of these difficulties is one which we make ourselves. It is the false preconception which we bring to the question, that the problem is insoluble, that no such thing ever was done or ever will be done; it is our misinterpretation of the American Revolution.—(Expan. Eng., p. 159.)

We, the promoters of the Federation League, aim at awaking these people, to many of whom Federation has no real meaning;—perhaps some here present have scarcely heard of it, and yet I am convinced that at this moment it is the question of most importance to Great Britain,—at any rate it is a question of absorbing interest to our kinsfolk in the Colonies.

I alluded before to the depression of trade, but most people are not aware from how much deeper a state of depression our Colonies have saved us. In the decade ending 1882 our exports decreased 8,000,000*l.*, viz., from 314,000,000*l.* to 306,000,000*l.*, but during that same decade our business with the Colonies increased 26,000,000*l.*, so that had it not been for the Colonies the decrease would have reached 34,000,000*l.* per annum. Well indeed for us that the Colonies came to our aid!

It has been noticed too that our trade with the Colonies is more steady than our trade with foreign countries,—and, comprising mainly articles of dress and of domestic consumption, and finished manufactures, finds employment for British labour, in trades in which Dr. Watson considers one-third of the population of the United Kingdom is employed; moreover, the same authority points out that the consumption of such articles is more than half as much again in Australia,—viz., 3*l.* 4*s.* there as compared with 2*l.* per head,—in England.

But steady and rapid as is this trade, it would receive enormous developments as our food supplies were drawn more and more from our territories beyond the seas. I took occasion to urge as long back as 1884 that by direction our food supplies might eventually be derived altogether from our own territories, and the strength of this country would be enormously increased if she were thus self-dependent.

A question often asked is, What will the Colonies gain by Federating? but the question should be rather, What will the Colonies lose if they do not Federate? In the case of Canada, Principal Grant, in reply to the question, What would Canada lose by independence? answers, Almost everything that a country needs.—(Imper. Fedr., No. 4, p. 193.) We are not inviting aliens more or less un-

willing to join us; then indeed it might be with them a question of the balance of advantages; we are urging upon our kin that they should not go out from us. This distinction is material, because evidently it may be to their interest not to leave us, though it might not be to their interest to enter into union with us; but premising that it is both inexpedient and unnecessary to balance this question with too much nicety, we may with profit devote a little consideration to it. The primary object of all Federal Unions is defence.¹ Now it may be said that if the Colonies by standing aloof should free themselves of all obligations in the matter of Imperial Defence they would free themselves from enormous responsibilities, and this is no doubt true as far as Europe is concerned, but they would remain exposed to greater perils in the event of a war of the first magnitude in which Great Britain was involved, and would rely for their existence upon the forbearance of others, for at present they are not, and for some time to come the strongest of them will not be, in a position to stand alone. Moreover, a great Empire with interests in every quarter of the globe is not likely to go to war for a merely local or frivolous object.—(Our Colonies and India. Ransome, p. 100.) In the matter of defence, then, the Colonies are no losers by closer union, while closer union means the advantages of British capital, increased security for commerce, favourable markets, and such other benefits, moral and material, as arise from membership in Great Britain, the freest, the wealthiest, the most glorious Empire the world has ever seen. This latter consideration cannot be rated as little in the scale, with some indeed it has most weight. In England we are so used to regard this membership as part of our birthright that we perhaps do not estimate the advantages and privileges attendant on it at their just value, but how they are esteemed by others is well shown by the natives of India, one of the reasons of whose wish to be enrolled in the Volunteers of India is “pride in the association with a noble Empire like that over which Her Majesty presides, and a desire to share in its glories by being numbered among its defenders.”—(Colonies and India, p. 121.) If our kinsmen beyond the seas, to use Seeley’s words, “more alive to the responsibilities and dangers than to the benefits of the connection, have the heart to sever themselves from English history, from all the traditions and memories of these Islands where their fathers lived for a thousand years, it will indeed be necessary to think that England is a name which possesses sadly little attractive power.”—(Expan. Eng., p. 155.)

It is scarcely possible to discuss Federation without saying something upon the commercial aspect of the question; to many the commercial difficulty stands most in the way of Federation, and so many advocate as the first step a Commercial Union. No doubt the commercial question bristles with points of contention, and I introduce it here that you may see that it has not escaped the attention of the League. Already the advocates of Protection and Free Trade are

¹ The Australian Colonies may soon be in a position to defend their own shores, but it will be long before they are powerful enough at sea to protect their Commerce, already important and steadily increasing.

confronting one another, while a third party which calls itself Fair Trade is eager to plunge into the fray, though with regard to this party, and without pledging myself in either direction, I may say that it seems to me that they must be either Protectionists or Free Traders; upon broad principles there would appear to be no middle course: yet the commercial difficulty need not appal us, the League does not press any view upon our Provinces beyond the seas; it sees that one or other view must be right, and that that view must eventually prevail, and in the meantime it is not apparent how these Provinces, though ever so closely united with the Mother Country, will be worse off than they are at present.

Protection would tax the goods of all Foreigners, and would lead to a war of Tariffs. Fair Trade would equalize taxation on British and Foreign products in the home markets, which seems to be Protection at home strictly regulated by Protection abroad; while Free Trade would leave commerce free to follow its own paths unfettered by restrictions of any kind.

Yet Free Trade is no new consideration for our Colonies; as early as 1775 Franklin, speaking for the Colonies, said if England would abandon her monopolies and give them Free Trade, they would contribute in peace. After the battle of Saratoga, Lord North sent out Commissioners, Lord Carlisle and Mr. Eden, to America, with power to offer to the Colonists Free Trade and seats in the English House of Commons, if America desired to be represented there.—(Froude, vol. ii, p. 204.)

This much, however, with regard to Free Trade, is indisputable, and should be borne in mind,—that Tariff disputes, a fruitful source of contention, would be avoided, and that the cost of collection, about 5 per cent. generally, would be saved.

Those who favour Protection are in the habit of pointing to the United States as the most prosperous nation in the world, and as having deliberately adopted Protection. I admit the prosperity, but it is a prosperity by no means untempered, and I for one prefer this old country, however it may be burdened. In reality, whether the States are better for protection is a moot point, but that their prosperity is mainly due to it is an assumption without warrant, and in any consideration of the matter we should not lose sight of the fact that the United States are in an exceptional position; they suffice for themselves, and being under no compulsion to resort to foreign countries for any of the necessities of life, are free to make any experiments they will.

Article I, Constitution of the United States, prohibits the United States, and the several States, from laying any tax or duty on articles exported from any State, and is, Maine says, the secret both of American Free Trade and American Protection. It secures to the producer the command of a free market over an enormous territory of vast wealth, and thus it secondarily reconciles the American people to a Tariff on foreign importations as oppressive as ever a nation has submitted to.—(Pop. Govrn., p. 246, 19th June, 1886.)

We, united with our Provinces beyond the seas, should be in much

the same position, and might create any Tariff we thought advisable in our own interests, though it can scarcely be denied that Tariffs increase prices to consumers, and that limiting our trade to our own Provinces would lead to much of our carrying trade passing away from us. At present we carry about two-thirds more than is necessary for our own use.

We do not lay down any particular formula for Federation, indeed we are particular to avoid formulating any scheme of Federation: we seek by continually ventilating the subject to familiarize the minds of all at home and in the Colonies with the idea of Federation, in the hope to induce them to wish for Federation, recollecting what Bagehot, who advocated Life Peers, said, "I am afraid we shall not soon see them, but as a first step we should learn to wish for them" (p. 127, Eng. Const.); that as a consequence there shall be spontaneous action from all sides towards Federation, and that out of this action shall be evolved that form of Union which most fits the circumstances of the case. This is an amplification of Taine's idea of our Constitution, which appears in his reflection, viz., that the mainspring of Government is not this or that institution, but certain energetic and very widely diffused sentiments, which we would more shortly designate as *Public Opinion*.

In the Colonies is an "ever-growing conviction of the impossibility of continuing in the same groove. The old machinery is worn out and must be replaced by new." But this much we do assume, that any League must be based upon *Representation*¹ of some form or another. It is so manifestly unreasonable to ask human beings to interest themselves, especially to the extent of self-sacrifice, in concerns in the administration of which they have no share, that we not only assume, but press, that they shall be admitted to a share in Imperial Representation. It is not for me to indicate how this may best be effected; it may be in the House of Commons; it may be in the House of Lords; it may be in the Privy Council; or it may be in a Council of Delegates from the Colonies, sitting under the Presidency of the Secretary of State for the Colonies. Difficulties attend the adoption of any of these, but the difficulties are not insuperable; modifications in the existing Houses will be needed, but modifications, nay reforms, are already insisted upon by many acquainted with their working, as absolutely necessary for both Houses even now; the tendency of the present seems to be towards placing local matters in the hands of localities themselves, in which case there may be no advantage in having so many members in the House of Commons, and thus room may be found for representatives of the Colonies in an assembly which will busy itself with none other but Imperial concerns. Who, too, can say what form reform of the House of Lords may take? Not improbably a more limited number of Peers, representative Peers and life Peers. Bagehot, discussing

¹ "Taxation the Colonies in 1767 would not submit to while unrepresented in the British Parliament" . . . "From authority to impose a tax, the step to despotism was short."—(Froude, vol. ii, p. 133.)

Lord Palmerston's proposal¹ to create Peers for life, says "the expedient was almost perfect;" thirty or forty such men added judiciously would have given "the House the very element which it needs so much, the most accomplished men in each department might have been added to it" (Eng. Const., pp. 122, 124);² at any rate the present House of Lords is not so in unison with the nation as its well-wishers desire that it should be.

In matters such as this of Federation, the hardest class to reach, and unfortunately it is the most numerous class, is the waverers,—the despondent, and the indifferent. What is to be said to them? To the despondent we would say that their spirit is not the spirit which led our forefathers to the acquisition of these Provinces beyond the seas;—is not the spirit which will enable us, their children, to maintain indissoluble the connection with them;—is not in short the spirit which has built up our Empire,—is not the spirit with which to encounter and to overcome difficulties. Upon them we would urge a more steadfast, a manlier policy,—we would urge that difficulties are not lessened by avoidance or by despondency,—that on the contrary, by constantly pondering them and turning them over in our minds, we shall become familiar with them, that familiarity will beget confidence in our ability to deal with them, and that confidence will issue in success.

But what is to be said to the indifferent? The indifferent may be indifferent either from ignorance or from apathy. The indifferent from ignorance we may educate, by "incessantly popularizing the principle" (of Federation) "by writing and speaking" (Bagehot, Eng. Const., p. 149), we may induce a spirit of curiosity which cannot but be beneficial. But the indifferent from apathy,—who are content with the existing condition of things,—who find it easiest to have no opinion,—who will not be at the trouble of following their fellow-men, so long as the exertion of following is more grievous than the penalties attaching to the isolation of indifferentism;—what of these? Of these indeed, unless from mere listlessness or the wantonness of indifference they lend themselves to unscrupulous and self-interested objectors, we need take little heed. If they are not for us, at least they are not against us, and even they may be roused to go with the stream, or if not roused may drift with the stream; yet whether they are or no is of little consequence, they are not the stuff of which men are made, they certainly are not the stuff of which the aggregation of men, which we call Empire, is formed.

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To every individual of the sons of men there comes a time of

¹ The creation of Life Peers might be rendered more effectual by the removal from the Peerage of unworthy Peers: this is not an absolute innovation. In Edward IV the Duke of Bedford, Geo. Nevil, lost his Peerage on account of poverty.—(Forsyth's Cicero, p. 91.)

² The rejection of this proposal was due to Lord Lyndhurst, and thus "the House of Lords rejected the inestimable, the unprecedented opportunity of being tacitly reformed."

choice, it may be sooner or it may be later, but it comes at least once during his lifetime; sometimes the issues before him are not very clear, sometimes they are unmistakable; but however that may be, the whole of his future career depends upon his choice.

As with individuals so with nations, to the inexorable rule of fate is no exception:—the present, we, the advocates of Federation, are convinced is the time of choice for this, our Nation:—the issues are unmistakably before her—the handwriting on the wall is large and clear—so clear, indeed, that she can scarcely avoid reading,—and, reading, ought not to go wrong.

The individual who leads his life isolated, apart, wrapped up in self, soon ceases to be of account among his fellow-men; so no nation can live entirely absorbed in its own affairs, least of all can Great Britain, with interests far off, far asunder, in all parts of the world; it is puerile—ought I not to say senile?—to suppose it. Great Britain live apart, in isolation? Why her whole course of policy, past as well as present, proclaims that she cannot—that intercourse is her very breath of life!

If this be so, why should the League intervene? Because what is everybody's business is too often nobody's business; because the present is an age when too many find their own affairs sufficient for their whole concern—when from mere lack of initiative, cessation of energy may ensue. Our kinsfolk abroad want far less rousing than we at home; they have far more inquisitiveness than we have, are far more incessant in action. Already people in the Dominion of Canada are saying that the time is ripe for a choice between Federation and Independence, and this not from unfriendly motives, but actuated by the most pious and filial feelings towards the Mother Country. Independence, in their present stage of adolescence, would probably end before manhood is reached in annexation to the nearest Great Power; Federation is, we think, an end more worth striving for. With his mind fixed on the British Constitution, an eminent writer¹ says: "If the new communities of the colonized world have to choose a Government, they must choose one in which all the institutions are of an obvious evident utility," and, subject to its power of adaptability to altered and to altering circumstances, the Government of the United Kingdom appears to me to answer best this description. This, however, I may, for myself, say: I commenced some months back to study more closely than I had hitherto done the Constitution of the United States, under the impression that it was the best adapted to the needs of a free—let us say the Anglo-Saxon—race. I find in it many points of excellence, but I find in it also great anomalies—greater even than in our own Constitution,—anomalies not sanctified as in our Constitution by prescription. I find further in it a rigidity which presents many and great elements of danger; and my conclusion, my deliberate conclusion, is, that its excellence is in spite of itself, and through the people, of whom the writer already quoted says: "The Americans extol their institutions, and so defraud

¹ Bagehot.

themselves of due praise." "If they had not a moderation in action singularly curious where superficial speech is so violent, if they had not a regard for law such as no great people has yet evinced, and infinitely surpassing ours, the multiplicity of authorities in the American Constitution would long ago have brought it to a bad end."

The conclusion I draw is, that our race can adapt itself to many, to any, modifications of representative Government, and that there are no inherent objections to the Federation at which we aim; in that Federation lies the true development of the nation, upon that Federation rests the prolongation of the nation's life. What nobler incentive to exertion for each and every individual of the nation than the worthy prolongation of the nation's life? It is well to fix our thoughts upon this—to aspire ever to a higher ideal! We have seen the fate of nations habitually wrapt up in their poor selfish present, and by their fate we should take timely heed. We cannot rest as we are—we dare not go back; but we may, we *must*, go forward! The future is before us! Let us go forward towards it in no unworthy spirit; then, whatever the result, we shall leave ourselves little to regret. Yes, the future is ever man's goal! What are the words of the Seer? "Think not mournfully upon the Past—it is gone. Wisely improve the Present—it is thine. Go forth to meet the Future, without fear and with a manly heart." Noble words, and true to all time. What a glorious future! As we lift our thoughts towards it, we may well feel our hearts aglow within us. Standing here, with my thoughts lifted towards Federation, I dare affirm, without fear of contradiction, and with no feeling of unfriendliness towards other nations, that in the union of the English-speaking races rests the best hope for the future of the world. Join with us then, we beseech you, now, while there is opportunity, in our endeavour to render that Union close and indissoluble.

The CHAIRMAN (Lord Carnarvon): Gentlemen, before I call upon any one to address this meeting on the very interesting paper that we have just listened to, I think it right of me to say that I have received a telegram from Captain Colomb, who read a very interesting paper here upon a cognate subject at a recent meeting. Captain Colomb is engaged at this moment in one of those Parliamentary contests in which so many of our fellow-countrymen are now engaged, and he telegraphs to me to say it is a great disappointment to him to be unable to attend here to-day to carry on what was then understood, I believe, to be the promise of an adjourned discussion on his paper. Under these circumstances he hopes that though of course the meeting to-day may take into account his paper in the discussion upon that which we have just heard from Sir Charles Nugent, on the other hand that the door will be left open to him by a further adjournment, which seems to be very reasonable, a few days hence, when his own electoral labours will be completed, to enable him to say a few words on the paper that he then read to you. I think now my best course will be to invite discussion from those who are here present. I understand we are favoured to-day with the presence in this room of some of my Colonial friends, if I may be allowed to call them so, and if there be any of them here who would desire to speak on this subject, which so closely touches them, I am sure it would be the wish of this meeting to hear them in the first instance.

General BRAY, C.B.: My lord and gentlemen, I hoped very much to-day to see a great number of Colonists present to discuss this most interesting question in fact the burning question of the day before the whole British Empire.

would not have risen had it not been that for the last two years I have taken a great interest in this matter, and knowing a good many Agents-General and leading Colonists in England, I have discussed the matter in various ways and directions. I have heard a great many of their opinions; and have been able to form opinions of my own, and come to certain conclusions. From the admirable lecture to which we have just listened, a thoroughly statesmanlike exposition of the whole question, I gather certain things, and the first thing is, that Federation is in the air, and that it must come, and the sooner it comes the better. The only difficulty is how it is to be made to come. The Colonists are for it, you are for it, and everybody is for it, and it is only the difficulty which surrounds the subject which prevented it coming before now, and which at the present moment is keeping it back. But those difficulties unquestionably can be surmounted, will be and must be surmounted, and the way to do it is to approach this question carefully, and with the assistance of the most able men in this country, taking into their confidence all the leading Colonists in London who are able to give the opinions of the peoples whom they represent on this most important question. This year will be known in the future as the "Colonists' year:" there are so many of them here, and they are all watching the political movements going on at this particular moment, to see how they will affect them. Federation, though greatly desired, is surrounded with much difficulty, and is not considered by some practical at the present moment. The reasons are these, that each Colony, Victoria, New South Wales, South Australia, Queensland, Cape Colony, Canada, has its own Parliament, its own military force, and all the elements of government which exist in this country. These Colonists are represented in London by Agents-General. That is a name which does not give the people of this country an idea of what the duties of these gentlemen are: they really in point of fact are Ambassadors from the Colonies to the Government; they represent the feelings and wishes of the Colonies on every question, social and political. These men, therefore, are the go-between, who tell the Government in London what are the wishes of the Colonies upon all the questions which affect them. There are also the questions of Imperial policy and mercantile policy. Both questions have been carefully touched upon by Sir Charles Nugent, but the Imperial question is absolutely the one that affects the Colonies and the Empire more than any other, because at the present moment they all look to England more for the Imperial policy than anything else, that which affects them most, and in which they are almost totally unrepresented. The Imperial question is this. I will give you an instance: the point that touches every Colony connected with this country:--Is Ireland to be destroyed, separated, or abandoned? That point is an Imperial question for the Colonies; it goes straight to the heart, and affects their position in every possible way. I am only taking it as an instance; if Ireland were separated, this country, the centre and head of the Empire, would be weakened too. The weakening of the heart of the Empire would weaken the connection of the Colonies in every direction. The Turkish question at present, which is a very great European question also, affects directly the interests of the Colonies, because if the Imperial Government in London were to make war with Russia, they would be directly affected. They would be put to enormous expense, they would have to defend themselves and to be defended. That is another instance in which the Imperial policy affects the Colonies and the British Empire. The third is a minor one, which sprang up the other day, and caused a very great sensation in the Australian Colonies, that is the question of the New Hebrides. A Colonist said to me lately, "You, in England, are thinking of nothing but your elections; there is not a Colonist in Australia who is thinking of anything but the New Hebrides, and how it will affect them." It is absolutely necessary that in some form the Colonists should have some control or voice in the Imperial policy of the British Empire. That is the main point that affects them. Now in Australia itself there are several countries, all having their Parliaments, all perfectly separate, and some of them very jealous one of the other. It has been mooted that they should federate, and Federation has been distinctly sought in this paper. What are the objects of Federation? Defence, external policy, extension of territory, international communication, regulation of commerce, prosecution of justice, extradition of criminals, and protection of copyright. Those Colonists find the greatest difficulty in federating together on the spot, and several leading

Colonists have told me that they do not want to confederate together. What they want to do is to draw the lines closely together, and to be bound tightly with the Government of London. That is their idea of Federation. The Tariff question affects the Colonies acutely. If they had no Tariffs they would have smaller revenues. The Tariff and the Imperial policy are the main questions that they have to consider, and I trust the able lecture which has been delivered will bring forth good fruit, and show to the Colonies that we are with them in every way, and wish for Federation too, and will bring about this Federation the moment they show us how it is to be done, and how this great Colonial and Imperial question is to be solved in the best interests of the Colonies, and to the increased strength of the United Kingdom of Great Britain and the whole British Empire.

MR. RUSDEN: I did not come to speak in this theatre; I came here merely to hear the English opinions on this point. I was aware that Sir Charles Nugent, with whom I am a colleague in the Imperial Federation League, felt very strongly on this matter, but I thought he would bring before us the Imperial view, so that it might be considered by this audience. I did not think a Colonist would be called upon here to express any opinion. I may remark with reference to allusions to the Australian Tariffs, that it is not quite correct to say that the Colonial Tariffs are all arranged with regard to protection. There are some of the Colonies which themselves consider free trade highly. That they do arrange their revenues so as to get a good deal of help from the Customs duties simply for revenue and not for protection, is absolutely a fact known to all of us, but there are very few of them who have arranged them with a view to protection, in order as they think to increase local production. The great question of Federation is being warmly considered throughout every Colony, as well as in England, but the great difficulty, it occurs to me, will be in England itself. Has England lost the old power to organize a Government? If she has, we may blow this scheme to atoms. If she can rise again as a country with power of self-government, power of management, power of enterprise all over the world, then it may be done, but if she is to call upon the Colonies to dictate a scheme, the difficulties may prove insuperable. Doubtless no scheme can be adopted which the Colonists cannot agree to; but if England is to be supine under the hand of a demagogue, and to say that she has lost her power of government, lost her sagacity, then you may give it up, but if you will thoroughly consider this matter and organize and show that you have the spirit of your forefathers, then no doubt the Colonies will help you.

THE HON. H. HOLBROOK: I have listened with very great attention to the very admirable lecture of Sir Charles Nugent's, which contains a great deal for serious reflection on the part of Colonists. Now I come from British Columbia, the nucleus of whose population was furnished by the corps that Sir Charles Nugent came from—the Royal Engineers—and from them has emanated a really loyal and true community in that far distant country on the Pacific coast. We also know the great assistance that the noble lord sitting now in the chair gave in assisting us in being confederated together, for without his able assistance we should not have been the powerful Dominion that we are at the present moment. Now I might say as regards British Columbia, we were a Crown Colony, and his lordship was in office when we were a Crown Colony, and he assisted us in being confederated with the rest of the Dominion. But we had great difficulties. We were dependent nearly entirely on San Francisco, and we saw that the time had arrived when it was almost an impossibility to get emigrants to settle amongst us; we therefore found it our interest to join Canada. A Convention was formed and delegates came before the Dominion of Canada. We came into the presence of one whom Canada honours, whom Canada looks to as her greatest light—that is our noble Premier, Sir J. A. Macdonald—and whose great scheme, which was to cut the Gordian knot of your Eastern difficulty as regards Egypt, was the formation of a railway from ocean to ocean as a means of protection to your commerce in England. I may say with regard to the Colonies generally, we are about having a Convention at which delegates will sit representing some 250,000,000 of loyal British subjects, loyal to their Queen and loyal to their flag. They honour and esteem their Queen, they honour and esteem the flag, and they are proud of being amongst you. But although we claim loyalty, we do not want to make ourselves more loyal than you

are in Great Britain : but we claim equal rights, one flag, one country, and one nationality. We claim that as Colonists ; and Sir Charles Nugent touched on this point in the very admirable lecture that he has laid before us showing the difficulties that there are in forming Confederation. Now Federation with England is a necessity. Here are your births over your deaths something like 440,000, and you have only sent to Canada 32,000 and to Australia 48,000. You are increasing your population and you must find outlets for them. Now in Canada we have land larger in extent than the whole of the United States, and only 5,000,000 on it, and I have told you we are loyal and true to our Queen. And when I say loyal and true to our Queen, it is no lip service. We have an army of 40,000 that can be increased to 300,000, and a reserve of sailors of something like 60,000, and with that nucleus we can show a bold front and all join together in one mass in Imperial Confederation. Australia can do the same as ourselves ; we can render Great Britain impregnable. As I have said, we sent delegates to Canada to carry out the plan of Confederation with British Columbia ; that will have to be done here, and the present Conference is a means. As regards your Tariff and protection, go to the Colonial Exhibition and see the prosperity of Canada in her manufactures ; but you want our men, you want our statesmen amongst you ; you want their counsel, and it is only through a Committee and the proper men being appointed that you can get their counsel. Whether it will be in the House of Lords or whether it will be in the Consultative Council, it is for heads greater than mine to think about, and for statesmen such as the noble lord who is now presiding over us.

MR. FRANC S. BRERETON : With your permission, I should like to make a few remarks, and I propose to confine myself as much as possible to opinions and statements made in the first page of Captain Colomb's very admirable paper—opinions and statements which I think go to the root of Federation. I think there are two well-known facts—facts which are generally admitted that it would be well to bear in mind : one is the military fact, that the strength of a fortress is but equal to its weakest part ; the second might be called the maternal fact, for few mothers can believe that their child has become a bearded man and is free from their control. Captain Colomb says the main features of Imperial Federation are the unity of Empire and the development necessary to preserve it. The first he goes on to say is based on the present and universal acceptance of the declaration that it is to the mutual material advantage of all parts of the Empire to be united. I should like to have added a word or two to that and said it ought to be, because I am afraid we shall have presently to consider as to whether the present connection between the mother country and her Colonies is to the mutual material advantage of all parts of the Empire. The statement raises the question as to what are the mutual material advantages at the present time. Colonel Colomb says that Imperial Federation has to do with facts commercial, political, naval, and military. Let us take the first. The facts commercial—what are they ? As for the mother country, her mutual advantages I do not question, and therefore I won't say more of that. I believe she has enormous advantages. But how is it with the Colonies ; what are their commercial advantages ? Have they any more advantages now than if they were severed ? Have they any more advantages than an ordinary foreign country ? Have they any more advantages than the United States of America ? I apprehend they have none. I apprehend if you go to our Colonial cousins and ask them, they will tell you they have none ; they will tell you that practically they are foreign nations ; that if they were severed to-morrow, so far as their commerce goes, they would be able to deal with England on exactly the same terms, that is, on the most-favoured-nation terms ; they have nothing better than that. They will tell you the mother country is constantly entering into commercial treaties with foreign nations, by which she binds herself not to give her children better terms than she does foreigners ; that at the present moment she is about to close a treaty of the same kind with Spain, but slightly different from former ones, because I believe, as a rule, in former treaties we had the power of closing them at the end of the year by a year's notice, but this treaty is to be for six years ; to bind us to a state of things of that kind is not wise. I think our Colonial friends may well say England by these treaties with foreign nations is selling their birthright. Therefore I hold that, so far as commerce goes, our Colonies actually have no advantage.

The next question is political: I think that has been answered already. A gentleman has told you here that the Colonies are liable to defend themselves in case of war, and yet they have no word in Imperial politics. The Federation League have not told us how or in what manner they propose to federate. How that is to be done is not for a humble individual like me to suggest. I had hoped in coming here this evening we might have heard it; I had hoped the Federation League would have been able perhaps at this meeting to put before us a scheme—a scheme not put forward by the Government of England, but put forward by the League, and then probably another League might have been made in the Colonies to consider and improve that scheme, and eventually to hand it to the Government of this country to propose to the Colonial Governments. The next question is naval and military. The paper of Captain Colomb's demonstrates beyond question that so long as the Colonies belong to the mother country, Federation for defence is an actual necessity; but at the same time I am afraid our Colonial brethren might take this paper and read it as an equally strong proof why they should sever from the Empire, because it shows them the necessity of protection, against what?—a war entered into by England—a war entered into by the English Government—a war possibly caused by the want of backbone in an English Foreign Minister. Therefore I hold that this paper, admirable as it is, is also a proof to our Colonies why practically they should sever. I submit that so far as commerce, politics, and army and navy matters are concerned at the present time, the Colonies have no beneficial interest in the connection. How is it proposed to give that beneficial interest in the future? I apprehend that commerce is the main way—the only way would be by commercial treaties, which would be beneficial to our Colonies. That would recognize our Colonies as being our children, which would enable them to trade with us upon terms better than the most favoured nation, better than foreigners, better than Russians, Germans, French¹. But a one-sided policy of free trade stands in your way; the question is, Federation of the Empire on the one side, free trade on the other. History tells us that nations are like men; they have childhood, youth, manhood, their prime, and old age and decay. Is England in her old age? Is she on the verge of decay? or is she only a child that has barely learnt to walk and has yet to run? I submit, with all deference, that it depends upon the two questions—will you have Federation and renewed national life, or will you have one-sided free trade and senile decay? You cannot have both; because if you do, then the foundations of your Empire will be only laid upon the quicksand of sentiment instead of upon the rock of mutual advantages. At the present time the questions of free trade and confederation have been before the country; how fares it with both? Five or six years ago I do not suppose you would have found a hundred men who would have dared to have said a word against that great one-sided free trade: if a man did, it was with bated breath. But what is it now? There is a powerful league called the Fair Trade League. Go right and left all over the country, and you will hear the word in men's mouths. Go in amongst our working classes and what will they say—"A one-sided free trade has taken the bread out of our mouths." When we speak to the man and say, "Look at the loaf you have—it only costs 4d." "What matters that, sir, I have no labour—no work; I have not a penny to buy it with; I would sooner pay 6d. for the loaf and have employment all day." Those views and opinions are spreading all over the land. I am not going to do more than call attention to the question at issue before the country, and to say that, so far as I am capable of judging, one-sided free trade has had its death-blow, and a few years hence it will be a thing of the past. With regard to Federation, five years ago it was hardly heard of; now, wherever you go you hear of it. It might be said that five or six years ago the bar of iron out of which it is proposed to forge the Fede-

¹ The United States of America receive from the United Kingdom of Great Britain and Ireland over 50,000,000*l.* per annum for food products, which by commercial treaties with our Colonies on protective duties on products from foreign countries, might be transferred to our Colonies, and thereby a great material advantage given to them.

ration of the Empire was laid before the furnace of public opinion. At one time it got a little hot, and the next it got cold. A kick would send it into the furnace, or, on the contrary, send it in the other direction. About a year and a half ago that kick came, practically caused by a whisper—an electric whisper—what might almost be described as a stage whisper, that grew in magnitude as it travelled—a message that left the Antipodes as a whisper and arrived in England as a shout, which proclaimed that the Colonies were prepared to join England in protecting herself. That kicked the bar into the fire, and there it is; able and willing men have their hands at the bellows. These papers that we have heard are a proof not only of their ability, but of their power and increasing energy. Are you willing to lend a hand? Are you willing, when the iron is hot, to forge it? Are you willing to put your shoulder to the wheel and drive out that one-sided free trade which stands in the way of Federation, and are you prepared to create in its stead a rock of mutual beneficial advantage, which would lay the foundations of a great Federated Empire?—an Empire whose strength would be sufficient to secure peace and prosperity for its people, and an Empire which in years to come would grow into a power which even the most sanguine of men have never dreamt of.

Captain CURTIS, R.N.: Sir Charles Nugent has said that the British imports exceed the exports by 187 millions; this surplus is explained by the English capital invested abroad; the country is paid in freight and merchandize. History also teaches us that countries do not live alone by a carrying trade, manufactures, or commerce: they should be, as nearly as possible, self-supporting, such as America, for instance. I do not know whether there are many landed proprietors here, but those that have their lands going out of cultivation would no doubt like to see fair trade, a certain protection put on wheat so that it should not be less than 40s. a quarter. No one could grumble at that. Of course the bakers and butchers, not the consumers, get the benefit of the present low prices. We have heard of the herring curer who wrote to Sir Robert Peel to say he was a free trader in everything but his own commodity, viz., cured herrings, and it is so with every one. In the case of foreign countries which have no money invested abroad, their exports pretty well balance each other. I was at a discussion at the Colinderies the other day about the emigration of children. We are all indebted to Miss Fry, Dr. Barnardo, and others, who interest themselves in sending out these poor children. The Colonists say: "Send us children with good characters." I should say, let the Colonies have groups, that is families.¹ Moreover, every man who leaves this country, whom the unions have driven abroad, competes with the mother country. In this country a man who can and will work has his labour limited. He should have what he can earn. Rome fell when she began to import her corn from abroad and allowed her own land to go out of cultivation. In our own time Italy is draining the Pontine Marshes. In England if you go into rural districts it is distressing to see the decrease of population; men flocking to the towns, and many becoming paupers. They sell all their goods and come up to town and pay 5s. or 6s. for a room, whereas in the country for 1s. or 1s. 6d. a week, they have a good cottage and garden and wholesome air.

Colonel ANDREWS, R.H.A.: Sir Charles Nugent in his preliminary remarks alluded to possible jealousies that must not be allowed to obstruct the question of Imperial Federation, but he would doubtless agree with the proposition that it would be desirable to remove any *reasonable* cause of jealousy on the part of either the mother country or a dependency. One such cause exists in the present depreciated and unstable value of silver, whereby a most unfair protective advantage is conferred upon some Colonies and our great possession of India, at the expense of our own home manufacturers and corn growers; and as commercial interests have a strong bearing on the subject, it may not be considered out of place in any dis-

¹ It is desirable that families should emigrate direct from the rural districts and not flood the towns. Some arrangement between the governing bodies and those of the Colonies might be arranged to place them where they may be self-supporting and repay any sum advanced to help them; in that way a constant touch and good feeling would be maintained with the mother country.

cussion of this question of Imperial Federation to urge that steps should be taken by Parliamentary inquiry towards re-establishing the stability of silver, the result of which would be to supply a much-needed stimulus to our home manufacturers by relieving them and our agricultural classes from a source of *unfair* competition, dependent not on the cheaper and better producing powers of the dependency, but on the fluctuating and depreciated value of coin.

Admiral the Hon. E. R. FREMANTLE: I am not inclined to contravene or dispute the statements that have been made by the last two speakers. I think it would be a pity if we should allow this discussion to diverge into questions such as free trade and protection, or the depreciation of silver, however important they may be of themselves. I think our friend who spoke so ably with respect to the advantages which the mother country gets from her Colonies and the lack of advantages which the Colonies get from the mother country, rather overlooked one or two points which are to be made in favour of the present connection. He compared the Colonies to the United States, and he seemed to overlook altogether the fact that the United States has very large independent establishments and is obliged to maintain a large diplomatic service, and also a considerable establishment of ships, and to spend a considerable amount of money for the protection of its trades. All that is done extremely efficiently for the Colonies by the mother country. I am not speaking now of the naval part of the protection, but in so far as the diplomatic part is concerned, I think that is well done, and I hope it is efficiently done by the representatives of Her Majesty in foreign parts of the world. If the Colonies were to separate from England they would have to do that for themselves, and to undertake a considerable expense. I think that is a question which has been to a certain extent overlooked. We have been told this is a question of Imperial policy, and undoubtedly a question of Imperial policy is one which is not likely to be overlooked by the Colonies. I was inclined to say that one quotation made in the extremely able lecture which we had the pleasure of listening to from Sir Charles Nugent might be read in two ways, when he says, "climates, not men's minds, by travelling vary." I think we might to a great extent dispute that. It has been made an accusation against a great number of people who live in this country that they do not travel, and that they do not understand in what Great Britain's Empire consists,—in fact that we are too parochial in our tendencies. Now I think that those who belong to the Colonies have a very clear idea that this great country is a great Empire. I think even those people in this country who go through the Suez Canal, and make possibly a holiday trip to Australia, come back with very enlarged notions of the greatness of this great Empire, and therefore I am inclined to say that that quotation made by Sir Charles Nugent may certainly be read in both ways, and I think our conceptions of this great Empire are enlarged very considerably by travelling. On the question of Imperial Federation I am quite sure that all those who were present at Captain Colomb's lecture, and those present to day, must be convinced that that is a necessity. I do not think we here have any "craven fear of being great," and I do not think we need consult any other countries as to whether we confederate for our own advantages or not. The question which has interested me is that I think some attempt should be made towards finding a practical solution of this great difficulty—how confederation is to be effected. I listened carefully to Captain Colomb's able lecture, and as far as I recollect the only thing he said on that point was that he thought that if some of our statesmen and some from the Colonies sat round a table, they would find a reasonable scheme. It was a very easy thing to say. No doubt there was a great deal of truth in it, but at the same time that does not advance us very far, and I think we have not advanced very much further to-day. We have been informed of the commercial difficulty, and that unquestionably is a very great one. I do not wish anyone to suppose that I underrate that difficulty; on the contrary I rate it so very highly that, having said that, I shall proceed to avoid it altogether for the present, because my wish is if possible to give some intimation as to how some attempts might be made towards the commencement of Federation. There are very few of us here present who have not read something at least of that charming book written by Mr. Froude,—"*Oceana*"—and we know very well that he thinks that some sort of Federation might be com-

menced through the Navy. On his arrival at Adelaide he is shown a little ship which his Colonial friends point out as their naval defence. He thinks that is very poor work,—it is only a little painted toy, it may look very smart but is no use for modern warfare,—and he says they would do much better to pay their money and to subscribe towards the maintenance of our Imperial Navy. I am obliged to digress into these particulars because there is a great point in that. Mr. Froude thinks it is simply a question of paying the money. I am quite aware the Admiralty would give us another version of that,—that this great desire to be joined to the Imperial Navy and to see the same flag, the flag of England, waving over the ships which they have assisted to pay for,—that this is a very natural, a very proper and very Imperial desire, but I think the Admiralty would say, and I believe truly, that the Colonists will wish to see something for their money. That is what the Admiralty will say,—when they subscribe in this way 50,000*l.* or 100,000*l.* a year, they will want to see their 100,000*l.* There will be certain people, whether from Adelaide, Melbourne or Sydney, who will say, “We have paid 100,000*l.* towards the Imperial Navy, where are the ships?” “They are protecting British interests in the Fijis and other places.” “Oh, but the Fijis do not pay for them.” I think that is the practical difficulty. Now I wish to explain how that may be got over. It appears to me it would be quite possible for ships which are intended to be used in our various Colonies to be practically paid for by the Colonies, that is to say, those ships that are for harbour use. Assume for the same argument that that little squadron which we have now at Melbourne; commanded by a Post Captain in the Navy, and which consists of one ironclad and a couple of gunboats, and a few torpedo-boats, if that were considered the harbour defence of that Colony, the ships not to be moved away except by permission of the Colonial Government, but that they were to all intents and purposes Imperial ships, the Admiralty manning them and appointing the Officers to command this Colonial branch of the Imperial Navy, it seems to me that would meet our difficulties to a very great extent. They would then have the benefit of the Imperial Admiralty superintendence; they would have Imperial Officers, the Imperial flag, the Imperial discipline, and that nevertheless the Colony would see something for its money.. Of course these vessels not being used for the South Seas, and not being as a general rule taken away from their Colonies, I can quite understand we should still have to pay for the ocean service as it were, but that is a matter of detail subsequently. It might be arranged that in addition to that the Colonies should be good enough to make a grant towards the Imperial Navy which was going to the South Seas. It seems to me some course such as that might be adopted, and that so we should obviate the difficulty which would naturally arise. The question of the flag is an extremely important one. We often talk sentimentally and we often talk figuratively of one flag. It means a great deal, and the one flag is one thing which the Colonists would like to see flying over the men-of-war which come to their ports. I wish distinctly to convey that that is the whole point of what I propose now, it is that the flag should be flown over ships manned from the Imperial Navy acting under the orders of the Admiral on the station, but with an understanding that they should not be moved away from that Colony without the assent of the Colonial authorities. I look forward then to that one flag being something which would be making a start, and that start would be made by the Imperial Navy. I refer once more to “Oceana,” and recollect how Mr. Froude tells us that the success of our Colonial Empire is due to the Navy, and if I have spoken at greater length than I intended with reference to detail, it is because I think detail has not been sufficiently considered. I propose then to begin with one flag, and under one flag we should have one policy and one Empire.

The CHAIRMAN: Gentlemen, I see the warning hand of the clock, and those who are accustomed to these discussions tell us that we must bring these proceedings, interesting as they are, to a close. Before doing so perhaps I shall have leave to make a very few remarks, and first of all let me say how sure I am that the heartiest thanks of this meeting will be given to Sir Charles Nugent for the extremely able and interesting paper which he has read to us. As to the question before us to-day, we are carrying on an adjourned discussion upon Captain Colomb's paper, which we are, so to speak, interweaving with the subjects which

arise under Sir Charles Nugent's paper, and those two papers together form, as it seems to me, a very homogeneous and complete subject-matter for consideration. The discussion this afternoon has, perhaps, ranged rather more over the political and commercial side of the question than over the military, but in this theatre it must never be forgotten how very much a part of this matter the naval and military consideration must be. I would venture to put before this meeting as clearly as I can that there are two aspects to be considered—first of all the naval and military aspect, and, secondly, the question of Federation itself as connected with that naval and military aspect. Let me say a very few words on the first of those. I would urge that the naval and military aspect is at the present day one of vital importance. Sir Charles Nugent touched upon it with reference to that gravest of all questions, our food supply from over the sea, the diminishing power of this country to keep its population in time of war, the incalculably enormous value of the carrying trade to us in a commercial aspect, and the risks that that carrying trade would be exposed to in time of war. He did not, however, dwell upon one other point which must never be lost sight of—the wasteful and ruinous character of naval and military scares at times when war is supposed to be threatening. Gentlemen, I have had, I am sorry to say, some experience of what those scares are, and I wish that any words of mine could convey to the country not only the gross impolicy of leaving matters alone up to the point when it becomes necessary to improvise fortifications and to devise military and naval expedients at the last moment under pressure of war, but also the ruinous character of those expedients when they are devised—money often thrown away, and even worse, because at the conclusion of the whole matter things are left in a position in which statesmen and Governments are tempted to rely upon these temporary expedients that have been devised until a fresh and perhaps still greater danger arises. Now, during the last year and a half or two years something has been done in the way of military fortification in our distant stations. I am quite aware that a considerable amount of money is being spent at Hong Kong and Singapore, but when credit is taken for that, let me remind this meeting that it is done almost entirely at the present moment at the expense of the Colonies themselves. England has, as far as I know, contributed extremely little to that outlay. We shall of course provide the armaments, but as far as I know the armaments are not in position, and the greater portion of the expense is being incurred by the Colonies themselves. Precisely the same thing may be said of two great and responsible and self-governing Colonies, Victoria and New South Wales. There, by the vigour and energy of those noble Colonies, very great and useful works are being undertaken, not one hour too soon, and a large sum of money has already been expended; but that has been entirely and solely at the expense of the Colonies, and, as far as I know, we have not subscribed one shilling towards it. I do not complain of that; it is right. If I had time to argue it, I should say that the Colonies are wise in spending that money on their self-defence; but, on the other hand, that we are bound also to give them all the assistance of our fleet in that part of the world. I might go further and say, if time allowed, how much remains of almost vital consequence which is left undefended both at home and abroad. I will not touch upon the home question, but I do say with the deepest sorrow that in spite of everything that has been urged by those who are familiar with this subject, the Cape still remains absolutely unfortified. Now, if there is any one single outpost of the British Empire in which the defence of our enormous Colonies is wrapped up, it is the Cape of Good Hope. The Suez Canal is doubtless of very great importance, but I believe there are many who will agree with me that enormous as the value of the Suez Canal is, the importance of the Cape is at least equal to it. For that nothing whatever has been done in spite of argument and earnest appeal. It is not that this Institute has to be blamed in that respect, for within these walls the voices of most eminent Officers have been lifted up on this subject; it is not the fault of the military or the naval profession, they have spoken out in no doubtful terms, it is not the fault of the press, they have exposed our dangers and difficulties over and over again. Nor can I take the blame to myself, for having been Chairman of the Defence Commission abroad,

and having sat on that for three years, together with some most able colleagues, and having expended an enormous amount of time and trouble over the subject, I have been compelled in the name of that Commission to protest against the negligence that was bringing this Empire into extreme danger. But the constitution of Government, of Parliament, and of public opinion is such that great questions are put aside for little ones, subjects of merely passing and ephemeral interest are allowed to usurp attention; there is a terror of spending 1,000*l.* now, when 100,000*l.* may be required a few months afterwards to redeem it, and above all there is a total absence of that continuity of policy without which the stability of Government cannot be insured. Well, that is the military and the naval aspect of the matter stated very shortly; now, let me say a few words on the second branch of the question, Federation, and how far that is interwoven, so to say, with military and naval considerations. I can assume the truth of what has been urged here this afternoon of the many and varied difficulties which beset this question. Admiral Fremantle said that he had hoped that a complete and actual scheme of Federation would have been laid before us. Gentlemen, I have heard this subject too long and too often discussed to indulge the hope that any actual scheme can be laid before us in a few hours' discussion; it is full of difficulties, and those difficulties are alike theoretical and practical. But I will venture to lay down three or four propositions: the first is this, that in my conscience I now believe the time has come when the bonds of England and her Colonies may be drawn much closer and tighter, but what this closeness should be in the way of political constitution I do not at this moment undertake to say. It would require a long time to define it or to approach it, but I say the time has come when those bonds should be more closely drawn. And in the next place I do not believe that there is any real or practical obstacle in the way. It was but a few weeks since that I was talking to a man of great Colonial authority and experience, Sir Alexander Stewart. It was, perhaps, the last political conversation in which he engaged, and I, without breaking any of the confidences of private talk, may at least say this much, that I think he agreed with me in believing, as I said, that the time had come for Federation, but that it was necessary to approach it by degrees and cautiously, that we must not in fact hope to devise at once a scheme that would provide for every condition and requirement, and that we must be prepared to go on tentatively step by step winning our way by solid, but at the same time by very gradual progress. And, thirdly, I will lay down this, that the complete defence of your coaling stations and your outposts abroad has, in the altered conditions of modern warfare, become absolutely essential for your Colonial no less than for your English commerce. Gentlemen, the conditions of war have greatly changed. Strangely enough, the conditions of attack and defence have been moving almost in parallel lines, and as one has advanced a little ahead of the other, so the other has in turn taken the lead. In one respect it may be described as favourable, and in another respect as unfavourable to us. But the one single condition which never can be lost sight of is that steam, and that which engenders steam, the supply of coal, has become the main factor in the commercial, political, military, and naval sum with which you have to deal, and unless those stations are adequately defended, there is no security for Colonial commerce any more than there is for English. But that can be done. The Commission of which I was Chairman proved that it could be done effectively, and at the same time at a moderate expense. And, fourthly, I would say that the feeling for a closer connection in these respects is one growing in the Colonies quite as much as it is in England, and I can speak on these points from the experience unfortunately now of a good many years. My whole public life has been, so to speak, colonially trained. When I went into the Colonial Office, as I think my friend Sir Charles Nugent has been kind enough to recall, as an Under-Secretary in 1858, I remember well what the feeling was then. I think indeed as Under-Secretary for the Colonial Office it was my business in those days to lay before the late Lord Derby the estimate for the first Colonial man-of-war that was ever sent out, I believe, the "Cerberus" at Melbourne. At all events, I remember well what the feeling was in 1858; I remember that what is now considered as commonplace could not then have been said. I remember again the state of feeling as to

the relations of the Colonies and the mother country when I was Secretary of State in 1867-68, and I remember noticing how great the advance had been. I remember again in 1874, during the time I held office as Colonial Minister, how many things it was possible to propose and to do which ten years earlier would have been impracticable. And, lastly, I remember what the feeling was as shown to me, and to the Commission of which I was Chairman from 1879 to 1882, and again how great the move in public feeling was. When my mind travels back over those four successive stages of Colonial experience I can only sum it up in this, that there has been an enormous advance of Colonial feeling in the direction which I have indicated, as indeed there has been in England on the same subject. And now, fifthly and lastly, I would say, that viewing as I do this Imperial Federation as the object to be secured, but perhaps not to be secured at once by any one Colonial chart or scheme complete in all its parts, but rather to be won by discussion and argument and step by step, I believe that there is no one measure which more directly tends to the object we have in view than that of military and naval defence. Military and naval defence seems to me at this moment the key-stone of Imperial Federation, and those who desire, as I do from the bottom of my heart, Imperial Federation, will keep their eyes steadily fixed upon that question of military and naval defence, because sure I am that that is the first, the most obvious, and the most expedient step to take in that direction. I say the most obvious and the most direct because the objections to it are none at all, the advantages of it are manifold, visible, almost tangible, and it is free from many of the complications which come in in so many other aspects of this large and grave question. Admiral Fremantle touched in this respect on one very interesting point—the different terms upon which we should enter into partnership, so to say, with some of those great Colonies in naval matters. I should take up a great deal too much of your time if I were even to argue that one single point. I will only say I have often and often considered it, and although I fully admit that there is the difficulty that these Colonists who have paid for their ships might be dissatisfied if they saw those ships taken away to a distant part of the Empire, still I do not look upon the difficulty as at all insuperable. I believe it can be overcome, and I would even say on that one particular point that it must be remembered that it often happens that the fortune of a war is debated, not on the particular point of the frontier on which the inhabitants would desire the battle to take place, but it may be fought 100 miles or even 500 miles distant; that in fact the fortunes of New South Wales might be decided at the Fiji Islands in time of war. That is a self-evident proposition, and no military or naval man would for a moment think of disputing it. It might be that the great battle of the campaign might be fought 1,000 miles off, and possibly in that case every Australian ship not only should be there, but would desire to be there on the spot to take part in it. There are many ways in which a partnership can be carried out. It might be by the Colonists themselves providing the ships; it might be by the Colonists providing money contributions; it might be by a closer union between this country and the Colonies, such as already been begun through naval cadetships, and which I hope may be carried through much further; and generally, I may say, I subscribe to what Admiral Fremantle has said, in desiring to see the Colonial and English Navy identified, living, sailing, fighting under one and the same flag. As regards the military side of the question, I believe for my own part that there are excellent materials in point of men in these great Colonies; all that they need is organization and discipline, and that organization should be, I hold, provided by the mother country; it alone can supply it. It is not to be had on the spot, and it can be supplied without any great expense or any great trouble by us. In the same way there are at this moment no adequate supplies of arms or ammunition or ordnance, and it seems to me wrong that distant Colonies should have to depend entirely upon Woolwich and Elswick in these matters. And now I have said enough on this subject; I will only close by saying this, that I believe there ought to be an understanding and co-operation with these great Colonies. An understanding I believe would prevent any serious obstacle if it be approached in the right spirit. Co-operation we have lately had ample evidence will be given by our great Colonies the moment it is needed. Both Canada and New South Wales

during the Egyptian campaign amply proved it. I, for one, therefore, believe heartily in Imperial Federation; I believe in it from its military, its political, and to a certain extent from its commercial side. I acknowledge the difficulties, but I believe that they can be overcome, and I rejoice when I see in a great and important Institution like this, which naturally exercises great weight, to listen to the opinions that we have heard which have been expressed in no faltering terms, and with no uncertain sound.

Admiral Right Hon. Sir J. D. HAY, Bart.: I hope the meeting will allow me to propose that we offer our thanks to Lord Carnarvon for having presided over us. We have been very fortunate to-day not only in the lecturer, but in the Chairman. The words they have spoken I think will do much to cement the union between the Colonies and the mother country if that be needed, and also to carry forward the great work of Imperial Federation which we all desire.

Admiral Sir E. FANSHAWE: I beg leave to second the resolution. We have always felt it to be of great advantage to this Institution when, on the occasion of an important lecture, such as the one of this afternoon, we are favoured with the presence of an eminent statesman in the chair, and we feel this most emphatically upon this occasion. We have to thank Lord Carnarvon not only for taking the chair and regulating our proceedings, but also for giving us a most interesting historical description of the progress of the Federation question with the Colonies in its most important aspect—namely, the military and naval defence of the British Empire. I am sure the discussion of this afternoon will be received with the greatest interest by the two professions which this Institution represents.

The CHAIRMAN: I am very much obliged to you for the compliment that has just been paid to me. It has been a matter of great interest to me to be present this afternoon.

Wednesday, June 16, 1886.

LIEUT.-GENERAL SIR ARCHIBALD ALISON, BART., K.C.B., &c., &c.,
in the Chair.

THE NEW MILITARY RIFLE AND ITS COMPARISON WITH OTHER MILITARY RIFLES, ENGLISH AND FOREIGN.

By Colonel H. T. ARBUTHNOT, R.A., Superintendent, Royal Small-
Arms Factory, Enfield.

IN the course of the few remarks I am about to make, I propose very briefly to trace the history of rifles from their first introduction into the Service to the present day, and then to enter somewhat more fully into a description of the new Enfield-Martini rifle (table, p. 914).

The idea of rifling a barrel with the object of giving a bullet a spin or twist is no new one. Rifles were certainly in existence 250 years ago, but the first time we hear of a rifle being used as a service weapon was about the year 1800, or a year or two later, when the old 95th, now the Rifle Brigade, had rifles served out to them. The rifle with which this regiment was armed was called "Baker's Rifle," so called from the name of the inventor. There were two patterns of this arm, one with eleven grooves, and one with seven grooves. The twist of rifling was one turn in 136 in.; its weight was 8 lb. 9 oz., and length, 3 ft. 9 $\frac{3}{4}$ in., the length of the barrel being 2 ft. 6 in., and bore 0.705. The bullet was spherical; before being rammed down it was wrapped in a grease patch, there being a cavity in the butt for carrying these patches. The object of the patch was partly to lubricate the barrel, and partly to make the bullet fit tight so as to take the rifling. But it was so difficult to force the bullet home when wrapped in its patch, that a mallet was served out with each rifle so as to hammer it down. The rifle was fitted with a sword bayonet.

I cannot trace how long this rifle remained in the Service, but although it was much disliked, owing to its inaccuracy of fire, as well as on account of the extreme difficulty experienced in loading it, no steps appear to have been taken in England towards discovering a more efficient weapon; whereas on the Continent experiments were being carried out continuously. About the year 1836, however, the Brunswick rifle was introduced into the Service.

| | |
|-----------------------------------|---------------------------|
| The weight of this rifle was..... | 9 lb. $6\frac{1}{2}$ oz. |
| Length | 3 ft. 10 in. |
| Weight of barrel | 3 lb. $13\frac{3}{4}$ oz. |
| Length „ „ | 2 ft. $6\frac{1}{4}$ in. |
| Bore | 0·620 in. |

Rifling, 2 grooves, 1 turn in 2 ft. 6 in.

This rifle was also fitted with a sword bayonet, weighing 2 lb. $0\frac{1}{2}$ oz.

The peculiarity of this arm was that the bullet, which was spherical, was “belted;” in loading, this belt was placed in the two grooves, this method being adopted to give the bullet a spin. A grease patch was also used with this rifle, which added to the difficulty of loading by making it extremely uncertain whether the belt was properly placed in the grooves or not.

This rifle was the first arm in the English service which had a percussion lock, and it was not until the year 1842 that a percussion musket was generally adopted for the Service.

The Brunswick rifle remained in the Service until 1851, when it was superseded by the Minié, which had some time previously been introduced into the French Army. Up to this time rifles were only issued to rifle regiments, but with the introduction of the Minié rifle it was intended to arm the whole Army with rifles.

The adoption of this rifle was a great step in advance; it was the first time the spherical bullet was discarded, and in its place was adopted one of a cylindro-conoidal form; the bullet had a hollow base, in which was placed an iron cup; on the explosion of the powder this cup forced the bullet into the grooves of the rifling; the grease patch was also discontinued with the adoption of the Minié rifle, lubrication being obtained by greasing the paper in which the bullet was wrapped with a mixture of tallow and beeswax. Some of the regiments in the Crimea were armed with this rifle, but it was cumbersome and heavy, and as early as 1852 experiments were made by order of the Master-General of the Ordnance, Lord Hardinge, with a view of obtaining a better weapon. The result of these experiments led to the introduction of the Enfield rifle, pattern 1853. The chief feature in this rifle was the large reduction made in the diameter of the bore of the barrel, viz., from 0·702 in. to 0·577 in. This reduction of the bore enabled the barrel to be made very considerably lighter without in any way impairing the efficiency of the arm as a shooting weapon; in fact it shot very much better, as the bullet was better proportioned. This was the first arm in which the bayonet was secured to the barrel by a locking ring.

There were two patterns of Enfield rifle, the long rifle for the infantry of the line generally, and the short rifle for rifle regiments and sergeants.

With the introduction of this arm also was the first commencement of manufacturing arms on the interchangeable principle.

The Enfield rifle continued to give perfect satisfaction until the Danish war of 1864 called attention to the very vast superiority of breech-loaders over muzzle-loaders. The Prussian Army had indeed

been armed with a breech-loader, the old needle gun, or "zundnadelgewehr," for very many years; but it was not till the Danish war that its superiority was manifested. There was immediately an outcry in England for our Army to be armed with breech-loaders, and it was determined, before waiting for an entirely new pattern of arm, to endeavour to convert the large store of existing Enfield rifles into breech-loaders. Experiments were made which shortly led to the introduction of the Snider rifle.

By the adoption of the Snider breech action, the old arms were readily converted, and new arms on this principle were also made in large numbers, so that by the time of the Franco-Prussian war, the whole Army was armed with breech-loaders, and during the winter of 1871-72 the Volunteers and Militia also received these arms. But it was perfectly well understood that the introduction of the Snider was only a makeshift; the Snider was merely intended to fill the gap until a more perfect and more efficient weapon could be devised. Trials on a very extended scale were conducted for some time, and in 1871 the Committee which had been appointed to consider the whole question reported in favour of the Martini-Henry rifle, and the same was finally approved in April of that year. Manufacture commenced shortly afterwards, and the first issue of Martini-Henry rifles to the troops was made in 1874.

This arm was vastly superior to the Enfield or Snider rifles in every respect. The diameter of the bore of the barrel was greatly reduced, viz., from 0.577 in. to 0.45 in., whereas the bullet was maintained at the same weight, and therefore being much smaller in diameter, was of necessity much longer, thus giving it far greater power of overcoming the resistance of the air; the charge of powder was greatly increased, so that the muzzle velocity was much higher. The long rifle was discontinued, and there was but one pattern of arm for all ranks.

There is but little doubt that, at the time of its introduction, the Martini-Henry was the finest military rifle in Europe. I am aware that there is much difference of opinion with regard to the merits of the Martini breech action, but although this action has now been tried in campaigns under every condition of climate and exposure, as an "action" it has never been known to fail. It is true there were many complaints of "jamming" in the Soudan, but this jamming was due more to the cartridge than to the Martini action, and had the same cartridges been used in a rifle with a "bolt" action, the jamming would have been much worse.

Before proceeding further, I should like, with your permission, to draw attention to the successive steps in advance which have been made as each pattern of arm has been introduced since the beginning of the present century. As this paper concerns rifles only, I have said nothing about smooth-bore muskets, but I may remark briefly that from the year 1800 to the year 1842, the infantry of the line, with the exception of the rifle regiments, was armed with the old "Brown Bess" of the Peninsula. It was not till the year 1842 that any alteration was made, but in that year a musket weighing 1 lb. less than the "Brown Bess," and having a percussion instead of a

flint-lock, was introduced. This musket remained the infantry weapon until the Enfield rifle was issued universally to the Army; for although it was intended that the Minié should have been the universal arm, there were never a sufficient number of this pattern of arm made for general issue.

With regard to rifles, the "Baker" rifle was a very primitive weapon, and had but few points of recommendation. The "Brunswick," which superseded it, had a percussion lock, and an endeavour was made to spin the bullet by fitting it into the grooves.

This rifle in its turn gave way to the "Minié," with a reduced bore and an elongated bullet, which was made to take the rifling by being "set up" by means of an iron cup or disc in its base.

The Enfield advanced further in this direction by greatly reducing the bore and still more lengthening the bullet. This was the last muzzle-loader. Then came the era of breech-loaders, the Snider leading the way, to be followed very shortly by the Martini-Henry, in which the principle of increasing the power of the rifle, as well as its accuracy, by diminishing the bore and increasing the length of the bullet in proportion to its diameter, was still further developed.

It was not till about the year 1879 that doubts began to be expressed with regard to the superiority of the Martini-Henry rifle over rifles in use in other countries; it was then found during some experiments which were being conducted by the Siege Operations' Committee at Lydd, that although the Martini-Henry rifle was superior to all other arms at ranges of 500 yards and upwards, it was inferior to them at ranges below 500 yards, so far as regards velocity and flatness of trajectory. The reason of this can be readily understood. In most of the foreign arms there is a greater proportion of powder to bullet than in the Martini-Henry rifle, consequently the muzzle velocity is higher, and the trajectory lower at short ranges. But the foreign bullets being lighter in proportion to their diameter than the English bullet, they have not the same power of overcoming the resistance of the air, and therefore the velocity soon falls off, and at ranges from 500 yards and upwards the Martini-Henry rifle has a higher velocity than the foreign arms. But it was considered desirable that the English Army should be armed with a rifle superior to the foreign rifle in every particular, and at all ranges, and it was for this reason that it was determined to make an endeavour to produce such an arm.

Before describing the new rifle, which is to be called officially the "Enfield-Martini," it will be as well to see in what particulars the foreign rifles were superior to the Martini-Henry, and in what particulars it would be necessary to bring up the Enfield-Martini to a superiority over the foreign arms.

I do not propose to enter into a full description of the principal arms in use in foreign countries, but I have specimens of them here from which it will be seen that the breech actions are all on the "bolt" system, with the exception of the Austrian arm, the "Werndl," which has a revolving block, and the United States arm, the "Springfield," which has a turnover block, and I have prepared

tables (pp. 912, 913), which may be of interest, giving particulars of these arms with regard to their weight, dimensions, velocities, trajectories, &c., in comparison with the Martini-Henry rifle. (Plates XXII, XXIII, XXIV). From this table it will be seen that, with the exception of the Jarmann, none of these arms have so small a bore as the Enfield-Martini rifle; but that they are all smaller than the Martini-Henry, except the Springfield, which has the same bore; they have all a higher muzzle velocity than the Martini-Henry rifle; at 500 yards the velocity of the "Mauser," the "Vetterli," and the "Werndl" is very slightly below that of the Martini-Henry; whereas, that of the "Berdan" and "Gras" is still slightly in excess of it, and the "Jarmann" still considerably in excess. At 1,000 yards the Martini-Henry is superior to the whole, except the Jarmann, which is still slightly in excess of it. At 1,500 yards the Martini-Henry beats even the Jarmann.

The highest point of the trajectory of these arms at the various ranges very nearly follows the velocities, except in the case of the Jarmann, which maintains its superiority to the end.

As regards the weight of the arms with bayonet, it will be seen that the Martini-Henry is lighter than any other arm with which it is compared, and also that, with the exception of the "Springfield," the value of $\frac{D^2}{W}$ is less.

It may be necessary, perhaps, to explain the meaning of the expression $\frac{D^2}{W}$.

This is the mathematical formula used in this country to denote the power of the air to retard bullets in their flight, where D is the diameter of the bullets in inches, and W its weight in pounds; therefore the smaller the value of $\frac{D^2}{W}$, so much less power has the air to retard the bullet; and *vice versa*, the heavier the bullet can be made in proportion to its diameter, the better able will it be to maintain its velocity at long ranges.

From what I have pointed out, it will be seen that in order to ensure the Enfield-Martini being superior *at all ranges* to the foreign arms, it was not only necessary to start with a high muzzle velocity, but to maintain it, by keeping down the value of $\frac{D^2}{W}$ to as low a figure as possible, and this was the problem set me to solve; a further reference to the table will, I think, show that the problem has been solved theoretically, and I trust that the trials now being carried out at various stations will show that it has also been solved practically. And here let me state that I wish to take no credit to myself if the rifle turns out a success; the credit is due to Major McClintock, and to others of the staff at Enfield, who so ably assisted me in working out the details of the arm.

I will now proceed to describe the Enfield-Martini rifle. (Plate XXII.) To begin with the barrel, this being the most important part of the arm.

It is very easy to obtain a high muzzle velocity, all that is necessary is a light bullet in proportion to the powder charge; but when you have to keep up a high remaining velocity the difficulty begins; then a heavy bullet becomes necessary, and with a small bore, a heavy bullet means a long bullet; then the longer the bullet, the quicker must be the twist of rifling, and the quicker the twist, the more liability there is to foul.

Before it was finally determined to recommend a barrel with a calibre of 0.40 in. for submission to the Committee, we tried barrels of various calibres between 0.45 in. and 0.35 in., always fixing the bullet at such a weight as to maintain the value of $\frac{D^2}{W}$ at about the same figure, viz., 2.9; but I finally settled on the 0.40 in., because I found that with that barrel I got most uniform shooting; with good ammunition it never varied, whereas, when we went below 0.40 in., although we sometimes got magnificent shooting, it was not always so uniform as with the 0.40 in. Another reason for not adopting a very small bore is that a bullet with a very small longitudinal sectional area is more affected by a side wind. The twist of rifling which gave the best results was one turn in 15 in., this is a remarkably quick twist, and for some time we experienced great difficulty in overcoming the fouling; we tried wads of every description, till at length we hit upon the wad which has since been adopted. It is a compound wad $\frac{1}{4}$ in. thick, consisting of $\frac{1}{8}$ in. of hard cardboard next the powder and $\frac{1}{8}$ in. of beeswax next the bullet. On the explosion of the powder taking place, the beeswax is flattened between the cardboard and bullet and then forced into the grooves; and the cardboard being "set up," also takes the rifling and cleans out the fouling. The barrel, therefore, as finally adopted has a bore of 0.40 in. or more, strictly speaking 0.402 in., the rifling has seven grooves with a twist of one turn in 15 in.

I come now to the sighting. As the rifle has a very flat trajectory at ranges up to 400 yards, as you will see by the diagram, it was considered desirable to have two fixed sights which should cover the whole ground up to 400 yards, so that at what may be called the fighting range the soldier will not have to fumble at his backsight. The point blank of the rifle has been fixed at 100 yards, and the small sight at the breech end of the barrel is true for that range, but firing with that sight and aiming at a spot about 5 ft. from the ground the bullet will travel 350 yards before striking the ground. As, however, for the last 50 yards of its flight it would be so near the ground as not to stop a man, it was determined to fit a leaf sight also at the breech end of the barrel, which when put up should be true for 300 yards; firing with this sight up, the bullet would travel 450 yards before striking the ground, so that by using one of these two fixed sights the whole ground is covered up to 450 yards. I may state in passing that the form of the V's and the form of the front sight was determined by the Committee; it is one of the points on which Commanding Officers are requested to report, and there will be no difficulty

whatever in altering them should the form as sent out on the trial rifles not be liked.

The elevating backsight is graduated for ranges from 400 to 2,000 yards. There is a wind-gauge attached to the slide. I am aware that some gentlemen would prefer to see a sight somewhat similar to that on a Springfield rifle lately obtained by this Institution. With regard to the V's, as I said, any form can be adopted, but with regard to the wind-gauge worked by a very small screw, the mechanism is too delicate to withstand the rough usage which a Service rifle must at times be subject to. And I wish it to be distinctly understood that this rifle is not meant as a Wimbledon match rifle, but as a strong, serviceable soldiers' weapon, and, at the same time, one which shoots with perfect accuracy.

I come next to the action. The action remains on the Martini principle by the express orders of the Secretary of State. It is not therefore for me to discuss whether a better action or not could have been devised, but in view of the possibility of the introduction of a magazine rifle, which would necessitate an entirely new action, I certainly think it is better to adhere to an action which is known to be serviceable rather than to embark on endless experiments which would all be thrown away if it were eventually decided to adopt a magazine arm. The only alterations made in the breech action of this rifle are the addition of a safety bolt which acts in the form of a screw and lever, lifting the nose of the tumbler clear of the trigger; and the adoption of a round tumbler axis instead of a square one. This is done because it is found that the square tumbler axis and hole are apt to wear, when the rifle becomes dangerous, whereas with the round axis there can be no wear; but with the round axis it is impossible to have an indicator as in the Martini-Henry arm, but the Committee did not consider this of vital importance. Some alterations have been made in the stocking of the rifle, which are thought to be improvements. The butt is made narrower so as to rest better in the shoulder, and with the view of meeting an objection so often raised, "that the stock of the Martini-Henry rifle is too straight," the angle of inclination of the butt plate to the line of sight has been made more acute, so that when the rifle is brought up to the shoulder the tendency is to keep the muzzle down.

I may remark here that it is a well-established fact that English guns of all descriptions are, and always have been, straighter in the stock than any foreign guns, and I presume the straight stock of the military firearm was adopted from the pattern in general use with fowling pieces—the bend of the stock has never been altered. In all changes of pattern, from the early days of "Brown Bess" up to the present time, the bend of the stock has remained unchanged, and it is only in quite recent years that an idea has sprung up that it is too straight. Without altering the bend we have endeavoured to arrive at the same result as would be obtained by a less straight stock, by setting on the butt plate at a more acute angle. A change also has been made in the form of the fore-end. In all military firearms up to the present time, the fore-end has been grooved out so that the barrel

should lie in it; the thin shell of wood which came up on either side of the barrel gave no additional support to it, and that form of fore-end had the disadvantage of holding water, so that the barrel was constantly being rusted on its underneath side. In the new rifle the groove in which the barrel rested has been cut away, and the barrel now lies *on* the fore-end, so that it can easily be kept free from rust. A wooden hand-guard has been added to the rifle, so that after rapid firing the soldier will still be able to grasp his rifle without burning his hand. We do not lay claim at Enfield for any originality in the idea of a wooden hand-guard, as several patterns have been brought forward from time to time. Mr. Westley Richards patented a wooden hand-guard as long ago as the year 1870. Colonel Morley, now commanding the 63rd Regimental District, brought the matter forward some years ago, and although he was not successful in getting it introduced into the Service at that time, nevertheless to him is due the credit of first bringing the idea prominently to the front.

I will now say a few words with respect to the quick-loader (Plate XXII), which it is proposed to serve out with each rifle.

This, as its name denotes, is simply a contrivance designed with the object of assisting the soldier to load quickly, especially in the dark, or in wet or cold weather. It is not intended to take the place of a magazine, but is so contrived as to present a cartridge in the readiest position for a man to load. It hangs on the side of the body of the action, and holds six cartridges. The cartridges are acted upon by a zig-zag spring, which forces each one in succession up an inclined plane, the head of the cartridge being forced through an aperture in the lid ready for the soldier to take hold of when he wants to load. When these quick-loaders were issued for trial it was found that in loading from the quicker-loader six rounds could be fired in about twenty-five seconds, whereas in loading from the pouch it took over forty seconds to fire the same number of rounds.

Having described the principal parts of the rifle somewhat in detail, I will now turn to the ammunition. The cartridge case is solid-drawn, and contains 85 grains of powder; the wad, as I have already mentioned, is a compound wad of cardboard and beeswax, the bullet weighs 384 grains.

With this cartridge the arm has a muzzle velocity of 1,570 ft. per second, which is higher than that of any other military rifle, and the remaining velocities at all ranges are higher also than those of any other arm. The penetrative power of the arm is sufficient to take the bullet through a quarter-inch iron plate at 200 yards; the arm shoots with great accuracy as the diagram will show.

By the adoption of this arm and ammunition a very great simplification will be effected, because instead of having four different patterns of cartridges as at present, viz., the solid-drawn Martini-Henry cartridge for rifles, the coiled case for rifles, the carbine cartridge, and the machine-gun cartridge, there will in future be but one cartridge for rifle, carbine, or rifle-calibre machine-guns.

I now come to the last part of my subject, viz., the bayonet. (Plate

XXIII.) There has been a good deal of discussion lately on the subject of bayonets, as you are no doubt aware, and therefore more than usual interest is attached to this subject at the present time. If we again go back to the beginning of the century, you will observe that there were then two kinds of bayonets, viz., a triangular bayonet for the muskets, and a sword bayonet for the rifles. There was very little alteration in the pattern of the triangular bayonet between the years 1800 and 1853; it had a short blade, and a heavy one in proportion to its length. But when the Enfield rifle was introduced, an effort was made to reduce the weight carried by the soldier; the rifle was considerably lighter than the old smooth-bore musket, and the bayonet introduced at that time was also lighter than that in use previously. The Enfield rifle bayonet had a blade 18 in. long, and it weighed 14 oz. On the introduction of the Martini-Henry rifle it was "bushed" to fit the reduced size of the barrel, and thus continued in the Service till the introduction of the bayonet of the present pattern; indeed, it may be said to be still in the Service, for there are even now some regiments in India which have still got this bayonet. It was always supposed that it was a good weapon, but although it may have been used on a few isolated occasions, it was never put to a very severe test until the campaign in the Soudan in 1884. Two regiments, the 1st Battalion York and Lancaster Regiment and the 2nd Battalion Royal Irish Fusiliers, in that campaign had come from India and brought with them the old Snider bayonets with which they were still armed. At the battle of El Teb the York and Lancaster Regiment used their bayonets freely, and they were then found to be miserably soft, and this led to the outcry against the whole of the bayonets. But although the Snider bayonet was still in partial use, it had been superseded in 1876 by the Martini-Henry long triangular bayonet. As at the time of its introduction lightness was still considered of paramount importance, the new bayonet only weighed half an ounce heavier than the old one, viz., $14\frac{1}{2}$ oz., but was $4\frac{1}{2}$ in. longer. There can be no doubt that it was too light in proportion to its length, but nevertheless it was a good weapon, and far superior both as to quality of metal as well as in manufacture to the old bayonet which it superseded. But in consequence of the experience gained in the Soudan, it was considered desirable to strengthen the bayonet if possible. More care was paid to the manufacture, a little more metal was put into the blades, and a more severe test was instituted. I have brought these tests here to-day that you may see the difference between the old and the new test, and that you may judge for yourselves as to the quality of the bayonets now in the hands of the troops. But on the introduction of the Enfield-Martini rifle, the question of the pattern of bayonet to be issued with it had to be considered, and it was decided to discontinue the use of the triangular bayonet which was of use for thrusting purposes only, and to issue in its place a short sword-bayonet, which could be used not only for thrusting, but which, when separate from the rifle, should be a useful and serviceable weapon. This sword-bayonet is a decided improvement on all sword-bayonets which have previously been in use; it has a very sharp

| Military Rifles, description of arm. | | | | | | | | | | Ammunition. | |
|--------------------------------------|---------|----------------|---------|----------------|-------|----------|---------|---------|---------|----------------------------|--|
| Country. | System. | Weight of arm. | | Length of arm. | | Barrel. | | Charge. | | Value of D ² W. | |
| | | Without | With | Without | With | Calibre. | Length. | Powder. | Bullet. | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Bayonet. | | Bayonet. | | | | | | | | | |
| lb. oz. | lb. oz. | ft. in. | ft. in. | in. | in. | grs. | grs. | | | | |
| Austria..... | 9 13½ | 11 8½ | 4 2 | 6 0½ | 0·433 | 33 | 77 | 370 | 3·547 | | |
| England..... | 9 0 | 10 0 | 4 1½ | 5 11½ | 0·45 | 33¾ | 85 | 480 | 2·953 | | |
| France..... | 9 4 | 10 7½ | 4 3¼ | 6 0¾ | 0·433 | 32½ | 80 | 386 | 3·416 | | |
| Germany..... | 10 4 | 11 12 | 4 4¾ | 6 0½ | 0·433 | 33½ | 75 | 380 | 3·453 | | |
| Italy..... | 9 9 | 10 14½ | 4 5½ | 6 2 | 0·408 | 33½ | 62 | 310 | 3·759 | | |
| Norway and Sweden.... | 10 1½ | .. | 4 4½ | .. | 0·397 | 32 | 77 | 337 | 3·222 | | |
| Russia..... | 9 12½ | 10 12¾ | 4 5¼ | 6 1¼ | 0·42 | 32¾ | 77 | 370 | 3·336 | | |
| United States..... | 9 5¼ | 10 1 | 4 3½ | 5 9½ | 0·45 | 32½ | 70 | 500 | 2·834 | | |
| England..... | 9 5 | 10 13 | 4 1½ | 5 11½ | 0·40 | 33¾ | 85 | 384 | 2·917 | | |

Military Rifles—Velocities and Greatest Height of Trajectories.

| Country. | System. | Velocities. | | | | | Heights of trajectories. | | | | | | | | | | |
|-------------------------|-----------------------|-------------|------|-----------|------|-----------|--------------------------|-----------|-------|----------|-------|-----------|-------|-----------|-------|-----------|-------|
| | | 500 yds. | | 1000 yds. | | 1500 yds. | | 2000 yds. | | 500 yds. | | 1000 yds. | | 1500 yds. | | 2000 yds. | |
| | | Muzzle. | f.s. | f.s. | f.s. | f.s. | f.s. | f.s. | f.s. | feet. | feet. | feet. | feet. | feet. | feet. | feet. | feet. |
| Austria | Werndl | 1439 | 854 | 620 | 449 | 328 | 8·252 | 49·41 | 162·6 | 426·0 | | | | | | | |
| England | Martini-Henry | 1315 | 869 | 664 | 508 | 389 | 8·594 | 47·90 | 147·1 | 357·85 | | | | | | | |
| France | Gras | 1489 | 878 | 643 | 471 | 348 | 7·769 | 46·6 | 151·8 | 389·9 | | | | | | | |
| Germany | Mausier | 1430 | 859 | 629 | 459 | 338 | 8·249 | 48·68 | 159·2 | 411·1 | | | | | | | |
| Italy | Vetterli | 1430 | 835 | 595 | 422 | 304 | 8·527 | 52·17 | 176·3 | 469·9 | | | | | | | |
| Norway and Sweden | Jarmann | 1536 | 908 | 675 | 504 | 377 | 7·235 | 42·97 | 137·6 | 348·5 | | | | | | | |
| Russia | Berdan | 1444 | 873 | 645 | 476 | 353 | 7·995 | 47·01 | 151·7 | 388·7 | | | | | | | |
| United States | Springfield | 1301 | 875 | 676 | 523 | 404 | 8·574 | 46·88 | 142·3 | 343·0 | | | | | | | |
| England | Enfield-Martini | 1570 | 947 | 719 | 553 | 424 | 6·704 | 39·00 | 122·0 | 298·47 | | | | | | | |

List of Rifles in the Service from 1800 to present date.

| Description of arm. | Without bayonet. | | Barrel. | | | | | | Bayonet. | | Ammunition. | | | Value D ^s of $\frac{W}{V}$. |
|---|--------------------|------------------------------|-------------------------------|-------------------|----------------------|-----------------------|----------------------|-------------------------|--------------------|------------------------------|----------------------|----------------------|---|---|
| | Weight. | Length. | Weight. | Length. | Diameter of bore. | Number of grooves. | Twist of rifling. | Sighted up to yards. | Weight. | Length beyond muzzle. | Charge of powder. | Weight of bullet. | Lubricator. | |
| Baker | lb. oz. 8 9 | ft. in. 3 9 $\frac{3}{4}$ | lb. oz. 3 14 $\frac{1}{2}$ | ft. in. 2 6 | in. ·705 | 7 | 1 in 136" | .. | lb. oz. 0 15 | ft. in. 1 6 $\frac{3}{8}$ | drs. .. | grs. .. | Grease patch. Do. | 5·886 |
| Brunswick..... Patt. 1836 | 9 6 $\frac{1}{2}$ | 3 10 | 3 13 $\frac{3}{4}$ | 2 6 $\frac{1}{4}$ | ·620 | 2 | 1 " 28 | .. | 2 0 $\frac{1}{2}$ | 1 9 $\frac{1}{4}$ | 2 $\frac{1}{2}$ | 557 | | |
| Minié..... " 1851 | 9 13 | 4 7 | 4 13 $\frac{1}{4}$ | 3 3 | ·703 | 3 | 1 " 64 | 1000 | 1 0 $\frac{1}{4}$ | 1 5 $\frac{3}{8}$ | 2 $\frac{1}{2}$ | 680 | Tallow and beeswax on paper. Do. | 4·356 |
| Enfield, long ... " 1853 | 8 14 $\frac{1}{4}$ | 4 6 $\frac{1}{8}$ | 4 4 $\frac{1}{4}$ | 3 3 | ·577 | 3 | 1 " 78 | 900 | 0 13 $\frac{1}{2}$ | 1 5 $\frac{1}{2}$ | 2 $\frac{1}{2}$ | 535 | Do. | 4·356 |
| " short ... " 1860 | 8 11 $\frac{3}{4}$ | 4 0 $\frac{1}{4}$ | 4 1 $\frac{1}{2}$ | 2 9 | ·577 | 5 | 1 " 48 | 1200 | 1 11 $\frac{1}{4}$ | 1 10 $\frac{3}{4}$ | 2 $\frac{1}{2}$ | 535 | Do. | 4·356 |
| Snider " 1864 | 9 5 | 4 7 $\frac{3}{8}$ | 4 12 $\frac{1}{2}$ | 3 3 | ·577 | 3 | 1 " 78 | 950 | 0 13 $\frac{1}{2}$ | 1 5 $\frac{1}{2}$ | grs. 70 | 480 | 3 canne- lures with wax. | 4·855 |
| Martini-Henry, Mark III, Pattern 1871. | 9 0 | 4 1 $\frac{3}{8}$ | 3 5 $\frac{3}{4}$ | 2 9 $\frac{1}{4}$ | ·450 | 7 | 1 " 22 | 1300 | 1 1 | 1 10 $\frac{1}{2}$ | 85 | 480 | Wax paper round bullet and beeswax wad. | 2·953 |
| Enfield-Martini . " 1886 | 9 5 | 4 1 $\frac{1}{2}$ | 3 13 | 2 9 $\frac{1}{4}$ | ·402 | 7 | 1 " 15 | 2000 | 1 8 | 1 6 $\frac{1}{8}$ | 85 | 384 | Cardboard beeswax wad. | 2·917 |

point, it has a keen cutting edge, and is strong and handy and will stand a severe test.

There is one point in connection with the rifle and bayonet together to which I wish to call your attention; the bayonet is fixed to the underneath side of the rifle, instead of being on one side, as previously. When firing with fixed bayonets, the bayonet on the side has a tendency to twist the rifle to that side, which makes the shooting bad; but when it is underneath, it has a tendency to depress the muzzle, which is an advantage, and when in that position it cannot be seen by the eye when taking aim, which is a further advantage, as there is nothing to make the aim unsteady.

I have now dealt with all the principal features of the new rifle, and have shown in what way it differs from the Martini-Henry. There are other minor points of difference which I have not mentioned, as they are not of so much importance.

I know that I have dealt very imperfectly with the subject I have brought before you, but I trust that the discussion which will follow will tend to bring out any points which I may have omitted.

Colonel Sir HENRY HALFORD, Bart. : There are one or two points in the able lecture to which we have just listened upon which I should wish for a little more information. I will not enter upon the previous history of the rifle up to the time of the Martini-Henry. The first point to which I should wish to draw attention is that relating to the action of the Martini-Henry, which the lecturer describes as "the finest military rifle in Europe." If that refers simply to the rifles in use in foreign Services I am quite willing to agree to it, but to say that it was the finest military rifle known in England at the time is to my idea not quite the case; because at that time there were military rifles in use at Wimbledon, perfectly good military rifles in every respect, in outside form and strength, equal to any military rifles in the world, and yet as accurate as the best match rifles are at the present time. Again, Colonel Arbuthnot says that the Martini breech-action was thoroughly satisfactory. I am afraid that that can hardly have been the case, considering that there have been so many reports from that time to the present as to its failure in action by jamming, especially when any sand got into the cartridges. Reports have been made from time to time from India and from the Soudan, according to which the rifles failed very completely. They have been much altered since, and I quite agree with what Colonel Arbuthnot says, that it would be unwise for this country to take a different action at the present time in view of a magazine-gun being probably supplied to the Army within a period not very long distant. The next point I wish to speak upon is that of the trajectory. I have taken some pains in getting out the trajectory, and I believe Colonel Arbuthnot agrees with me that the formula as used in getting out these trajectories is one not applicable to small arms. Colonel Arbuthnot and I have argued this matter out very fully, and I understood him to agree with me that the way in which I arrived at my conclusions was practically a correct one. No doubt he will say it is a comparative matter, and that in comparing the new Enfield-Martini with foreign arms you get at a certain comparative result. That is not altogether correct, because trajectory depends not only on the initial velocity and the value of $\frac{D^2}{W}$ irrespective of shape, but very materially on the shape of the bullet, and at 2,000 yards even to the amount of something like 8 or 10 feet. I should not have mentioned this subject had not the difference between us been so enormously great as it is. Calculating the trajectory by using the sight as a theodolite, I find a difference of 60 feet between the trajectory laid down by Colonel Arbuthnot and that which I believe to be the accurate or closely accurate trajectory. Whatever the errors are, and there are slight errors in the way in which I worked it out, those errors are all in the same direction—that is, magnifying the trajectory—as

those of Colonel Arbuthnot. Therefore I am overstating it when I say it is 229 feet for 2,000 yards, whereas Colonel Arbuthnot put it at 298, a difference of close upon 60 feet. At 500 yards the difference between us is about 6 inches, and at 1,000 yards about 4 feet. I have consulted with Mr. Bashforth, who got out the tables used by Colonel Arbuthnot, personally upon the subject, and there is no doubt the differences are due to lead being used in small arms, and to iron and steel having been the substances with which his experiments were made, and most careful experiments they were, some years ago. I have worked out the trajectory for the 10-inch gun on the same principle as these I give for small arms, and I perfectly agree in the trajectory that Mr. Bashforth's formula gives, and this proves my case, and I think I am justified in saying that where different metals are used different coefficients of resistance are required to work out the trajectories. No doubt the principles adopted are perfectly valid for use with a proper coefficient for a lead bullet of a certain shape. However, this matter does not affect the rifle, but only our knowledge of what it can do. There is a very much more important point, upon which I observe Colonel Arbuthnot does not touch, and that is the shape of the grooves. He does not tell us what shape he intends to adopt as the final pattern of groove in the rifle. The last patterns which I saw were the ratchet, but the pattern that I have been advocating all through is the segmental form, a form well known to riflemen at Wimbledon, easy to make and easy to repair, and distinctly, in dry weather, more accurate than any other form of rifling. Colonel Arbuthnot has pointed out two diagrams: the 500-yard diagram is a fairly good one, but the 1,000-yard diagram I do not call a good one, it is too much up and down. It was evidently fired on an exceedingly good day, because the lateral deviation is very small, but the up and down deviation is too great for a rifle at 1,000 yards. The difference of accuracy between the two patterns of grooving does not amount to very much in this damp climate. Last summer it came to something, but in India it comes to a very great deal. It is no use making experiments in this matter except in certain weather, that is to say, in very dry weather. The point is this, the ratchet has one deep side and rather a sharp edge; how much that edge has been taken off I do not know, but still the principle is to have a distinct edge of rifling on one side. The segmental rifling is an easy and even curve, and is sufficiently shallow to give the least possible hold to fouling, while deep enough to hold and spin the bullet. I am very anxious upon this point, as a great blunder will be made if the ratchet is adopted. I believe that a certain number of segmental rifles have been made. Practical shots of the present day will always pick a rifle with segmental rifling in preference to any other, because they know they can do better work with it in all weathers. I know that a letter was written to a leading rifle-maker in Ireland, asking his opinion as to the ratchet, and his answer was a very amusing one. He said the ratchet was his first love, but that he had soon seen reason to give that up; he then tried nearly every form of rifling known, and he had come to the solemn conclusion that the only form worth making was the segmental. That is a very strong opinion from a very practical man, and I mention it because, as he has been an opponent of my friend Mr. Metford, it is a thoroughly unbiassed opinion, and if he could have said anything honestly that would have gone the other way I think he might have done so. There is no doubt it is an entirely outside opinion free from bias by me. As for these segmental grooves, they certainly are the easiest form to cut. I have inquired of every gun-maker that I know who has been in the habit of cutting them and also of cutting other grooves, and they all with one accord tell me that they prefer the segmental to any other form of groove. In the matter of the experiments which Colonel Arbuthnot has told us he has carried out, I must confess I think the experiments which have been made by hundreds of men shooting for their own honour and profit during the last fourteen years with the military breech-loader are very much more to be depended upon than a series of experiments from machine rests carried out by foremen at any establishment, however well conducted. I am not in the least throwing any slur upon the Enfield Factory or upon the way in which it is conducted, but the experiments of the shooting men, carried out by firing in all weathers from the shoulder, are to my mind far more exhaustive than any experiments that can be conducted by one or two individuals from machine rests at one establishment.

These experiments by practical riflemen have been conducted at no cost to the Government, and have certainly produced the finest rifles in the world. Witness, for instance, the matches that we have had against the Americans with them, and the work constantly being done in this country with them. Colonel Arbuthnot shows us a cartridge which I have not seen before. Unfortunately, I have not seen any of the cartridges made lately, and I do not know what cartridge is being used now; he informs us that the bullet is put in by pressure.¹ I must say it would have been courteous on his part to acknowledge where he got that plan of putting in the bullet by pressure. That was Mr. Metford's plan, and it was with some difficulty that the authorities were ultimately persuaded of its advantage. It is Mr. Metford's invention, and it has been carried out for the last fourteen or fifteen years for all his cartridges. I am only glad to find that it has been adopted, and I think nearly as great honour is due to those who will adopt the best work as it is to those who invent it. I hope it will be understood that I have no wish to say anything in the least finding fault with the work done at the Enfield Factory; I am only desirous that everything should be done for the good of the Service and for the good of the country. If it had not been for that, I should have saved myself a great deal of annoyance and trouble, but let that pass. All I hope is that the best rifle will be adopted, and by the best I mean with segmental rifling; that the best ammunition will be adopted, and then I have no doubt that this country will have an arm, not only equal, but far superior to that of any other country in the world.

Lieutenant-Colonel HORE, *U.C.*: I will begin, Sir, by saying that I am quite sure no apology is needed from Colonel Arbuthnot, for I never heard a better lecture on any subject as an explanatory statement of what the lecturer desired to explain. I say that, because I am afraid I disagree with Colonel Arbuthnot on some points, and therefore I desire further to say that this is the first time in my life that I have had the pleasure of seeing him, that I have never had anything whatever to do with him either officially or privately, and that I have no sort of bias in the matter. I will begin by making one very slight historical correction with reference to the old Minié rifle. I have no recollection of seeing any smooth-bore muskets in the Crimea. My impression is very distinct that *all* the regiments in the Crimea were, in the first instance, armed with the Minié rifle. As regards the iron cups being driven through the bullets occasionally, I can give him a very curious corroboration of that statement. On the 7th of June, in the Crimea, I found a wild Irishman hammering with a great stone on the top of his ramrod, which was sticking out more than a foot. I knew what was the matter, so I took the rifle away from him and hid it, and told him to take a dead man's rifle. In the morning I recovered the rifle, brought it into camp, and made the armourer-sergeant take out the breech, and found that there were no less than eight of these lead cylinders sticking in the barrel, and this man was hammering down a ninth bullet. Now, Sir, I read with very great pleasure the admission that Colonel Arbuthnot makes as regards the Martini breech action, and I will just read his words. He says, "I am aware that there is much difference of opinion with regard to the merits of the Martini breech action." I consider the Martini breech action to be the worst that was ever invented. I have not invented any small arm myself, therefore I am not speaking for my own arm, but, so far as I know, the Martini is the only breech action which necessitates a straight cartridge describing a curve in entering or being withdrawn from the barrel, and I think there can be no doubt that quite as much of the jamming that we have heard of in the Soudan and elsewhere has been due to that absurd action as to the very bad Boxer cartridges. No other European country has adopted the Martini block, and therefore presumably its inventor was unable to convince any other country that it was a good one, just as no other country has adopted the absurd Boxer cartridge, unquestionably the worst cartridge ever made, and I humbly submit that this is also the worst breech action. And here I will tell you a little anecdote both about breech actions and about cartridges. Just 29 years ago I was appointed Attaché to H.M. Legation at Washington, and on the 19th December, 1857, I sent home a report on the new breech-loading Morse rifle. I

¹ Explained *visà voce*.—ED.

sent home also lettered diagrams as carefully drawn as I was able to draw them, and a strong report in its favour. So strong and so startling was the statement that I was able to send home, that I was immediately ordered to buy one of these rifles, contrary to the ordinary usages of the War Office, and also a thousand rounds of ammunition, and to send them home. When I had done that, my part of the work was over, but a couple of years later, being in London, I asked what had become of this rifle, and I was told it had been submitted to the usual Committee, which had sat upon it the usual number of months, and had made the usual report. I asked if I might see the report, and the answer was "Certainly." It was as follows:—That it was a very ingenious invention, and it really would do what I said it would do, but it was not adapted for the British Service (it might do well enough for Yankees, French, or Russians), for the three following reasons:—(1.) It fired too quickly—12 rounds a minute; (2.) the cartridges were metallic; (3.) they contained the principle of their own ignition." That was the first metallic cartridge, I believe, ever seen in this country, and I believe the inventor, a certain Mr. Morse, is the true inventor of the metallic cartridge. When the celebrated War Office advertisement came out after the battle of Sadowa, inviting competition for the British breech-loading small arm of the future, that advertisement left everything pretty well open to the inventors, such as length, weight of barrel, calibre, breech action, and so forth, but it went on to say that "all competing rifles must fulfil the three following *sine quâ non* conditions:—(1.) They must fire not less than 12 rounds a minute; (2.) the cartridges must be metallic; (3.) they must contain the principle of their own ignition." Ever since the appearance of that advertisement I am bound to say I have lost all respect for constituted authority. Now with regard to the calibre of the proposed new arm. Certainly 0·46 is an improvement upon 0·45, but I think (if Colonel Arbuthnot will allow me to say so) that my respect for constituted authority is not quite sufficient to enable me to come to the conclusion that 0·40 is the best possible form. That is another question, and I think, if we are to go to the expense in this country of a new rifle, we ought not merely to have the best rifle that Enfield can turn out, but the best rifle that the world can turn out. I think it ought to be thrown open to public competition. Let the best man win, and let us have something approaching finality—the best small arm that the science of the present day, and the workmanship of the present day, can possibly produce. As regards the breech action, I cannot quite assent to the proposition that we must preserve the Martini block because we may have a magazine rifle at a short date from now. If so, let us have it at once. It seems rather a waste of money to introduce an intermediate rifle between the Martini-Henry and this imaginary magazine arm of the future. Let us make one bite of the cherry; it is not a very big cherry. There are plenty of magazine rifles in existence which could be adapted to well-known existing movements, and I do not think that anything in the nature of an experimental breech would be required. I say this with the more confidence because Colonel Arbuthnot says that the action remains on the Martini principle by "the express orders of the Secretary of State." I have now come to understand that the phrase "Secretary of State" is really nothing but a bugbear. Of course, by the Secretary of State, Colonel Arbuthnot does not mean Mr. Campbell-Bannerman; I presume he does not even mean Mr. W. H. Smith, at all events—

Colonel ARBUTHNOT: I referred to Mr. Childers.

Colonel HOPE: I am very glad to hear it. I do not know that Mr. Childers' successes in the Navy and in the Army have been so great as to prove his opinion absolutely infallible; at all events, I think the opinion of a Board of infantry Officers who have got to use the rifles would be superior even to that of Mr. Childers. That perhaps brings me to the organization of the Ordnance Department. Colonel Arbuthnot is probably as good a man as possibly could be obtained for superintending the factory at Enfield, but I do not know why it should always be an Artillery Officer who settles the form of infantry rifles and cavalry swords, infantry bayonets, cavalry lances, revolvers, and all that kind of thing. I think the artillery have not had such a brilliant success with their own big guns as to justify them in settling the arms of other branches of the Service. I desire, Sir, in conclusion, to enter a very strong protest against that Martini block. I believe it really is, as I have said, the

worst that ever was invented, and for this reason that it forces the straight cartridge to describe a curve in entering and quitting the barrel.

Captain H. JAMES : When I came down here this afternoon it was chiefly with regard to the question of the breech action of the new rifle. Colonel Arbuthnot, however, has said it is retained by express orders of the Secretary of State, and there is, therefore, nothing more to be said on the subject. The Secretary of State is, I am aware, an impersonal entity, and is a difficult person to get at ; but in this case the veil has been torn asunder and we are told the gentleman to whom we owe this continuance of the Martini breech in the Service is Mr. Childers. I am perfectly well aware that the Martini breech action is an action that has gone through several campaigns with complete success so far as the action is concerned, but I cannot also be oblivious to the fact that the same may be said with reference to the bolt action—the universal action of every other nation on the face of the globe. Therefore it seems to me, if the argument of the success of a campaign is true of the Martini-Henry, equally is it true of the bolt action. But there are two other reasons why the bolt action should be adopted in any future years rather than the Martini. In the first place the Martini action, by the method of its construction, can never have so efficient an extractor (I venture to differ from Colonel Arbuthnot in his dictum on this point) as can the bolt action. In the bolt action the bolt acts directly on the cartridge, whereas in the Martini you are using the short end of a lever to move the long end to eject the cartridge, and that was one great cause of its failure in the Soudan. If you open the Martini-Henry gun with a jerk your cartridge comes out, but if in the heat of an action you do not open it with a jerk, as may happen if you are not quite as cool as you might be when practising at home—if under those circumstances you do not open it with a jerk, the cartridge does not come out, and then you have very often to go through a long process before it is extracted. I am perfectly aware that one great reason why the cartridges did not come out in the Soudan was owing to their faulty construction, but so long as you have the Martini block in the Service so long will you have jams due to the particular action of the block itself, and therefore the block breech-loader can never be so effective with respect to the cartridge as the bolt. With the millions of fire-arms existing at the present moment in every nation of Europe it is quite out of the question to expect anybody to believe that you cannot extract the cartridge with the bolt action as well as you can with the block action. The second reason why the bolt action is the action of the future is that almost every form of repeater which can be possibly introduced into the Service will have the bolt breech action. The repeating rifle is a question, not of the future, but of the present, for it is almost certain that Austria will at once adopt a repeating rifle which has been experimented on in that country. The same is the case with the German Army. We know a story was told some little time ago in the papers about a Frenchman having stolen a new repeater from the guard-house in Berlin. We know also that for some years the French Government have been making experiments with different forms of repeating rifles because the Kropatschek action used in their Navy has not been thought to fulfil the necessary conditions. The little State of Switzerland, a State which in this particular characteristic has always been the foremost in Europe, has for many years had a repeating rifle. They are now experimenting with another rifle, one which has a very much smaller bore, which carries a lighter bullet, and has a still more flat trajectory than even our proposed new rifle. It seems to me, therefore, considering the fact that there is a repeating rifle in the immediate future,—with the highest respect for Mr. Childers as an authority upon rifles, for I had not hitherto known that that was amongst the many things with respect to which he claims authority,—with the highest respect to him, I venture to think that in any future rifle adopted in the British Service the bolt and not the Martini block should be used. I have one more reason. Anybody who has fired the Martini-Henry lying down knows that it is an awkward weapon to work. The lever being underneath the barrel, you have to turn the rifle round, and it is difficult to extract the cartridge. On the other hand, the bolt action, such as the Mauser or the Gras, or any of the Continental weapons, can be loaded perfectly easily whilst lying down, and the bolt action is infinitely better adapted to cramped positions than any form like the Martini-Henry, where the lever to move the block is underneath. I

venture to differ from Sir Henry Halford on one point on which he differed from Colonel Arbuthnot. I have no hesitation in saying that for a military weapon the Martini-Henry rifle was, except at very short ranges, a far superior weapon to any other weapon which has been used in any Continental army. And that I think is shown by the Russo-Turkish campaign, in which the Turks had practically our own rifle.

Sir HENRY HALFORD: I never said it was not; I said, if it was compared with the rifles in use in foreign armies, it undoubtedly was the best, but if it was compared with other rifles known in this country it was not the best.

Captain JAMES: Then I withdraw my observation. May I say one word in regard to the quick-loader, which very much resembles the Krnka, tried first of all in Russia? It seems to me that anything put on the side of the rifle is bad. For the same reason that the bayonet has been justly turned round, it seems to me to be a bad arrangement to put the quick-loader at the side. The quick-loader is a clumsy substitute for the proper repeating rifle.¹

Lieutenant-Colonel W. C. MACKINNON: I have not had much time to give to the examination of this rifle, but there are many details in it to which I take exception, and these will doubtless be worked out during the practical tests which it has to undergo. There is one point in particular in the lecture with which I cannot agree, it refers to the "jamming" that we have heard so much about, and which the lecturer says is due more to the cartridge than to the action; my experience is the reverse; I have had many opportunities of visiting regiments where jamming has been complained of, and in all such cases, without exception, I found that the actions were out of order, that when pressure had been brought to bear on the armourers, and the actions properly adjusted, jamming practically ceased. Jamming is not, in my opinion, so much the fault of the cartridge as of the action; and I may claim some indulgence in speaking of this matter, because I was a sharer in the responsibility of the introduction of the Martini action: when recommended, it stood the tests better than any other action in the competition; the Boxer cartridge was also the best, there was no other cartridge at that time to touch it. With reference to the action of the extractor; instead of the hand working directly on it, the power is conveyed through a series of levers; the cartridge is expanded with immense force, and is consequently tightly held by any dirt or corrosion in the chamber, and the great power necessary to ensure extraction cannot be exerted and properly applied through this series of levers; minor alterations, such as strengthening the extractor arm, may be made, but with the faulty principle the liability to jam will remain. I know it is said that this action is simply a stop-gap, but there is the fear that, once reintroduced, it will be kept on for a long time; there may occur difficulties in altering it, financial, for example; and I consider that its maintenance in the Service until a magazine arm shall be devised, manufactured, and issued would be as great a misfortune as to reproduce ships of the "Warrior" type. With regard to the barrel; the conditions of low trajectory at all ranges, high muzzle velocity and favourable retardation, have been so cleverly combined that, providing it will not foul in excessively hot dry climates, and that its accuracy will be represented by the small diagram shown to us, I think we may be satisfied.

Admiral SELWYN: I should not have risen on this occasion at all but that it seems to me that we are forgetting that most important contribution to the whole subject that was made by Colonel Brackenbury; he called it the "Spirit of Artillery," and I say without fear that to those who will study the question in the spirit in which he attacked it the question of trajectory is one that can be met entirely by the regulation of the powder charge and the bullet, not by any change in the arm;

¹ I said nothing about the cartridge of the new rifle, but I am given to understand that the reason why the bottle-shape was retained is that the Royal Laboratory refused to manufacture the more modern truncated cone form. One of the difficulties that Enfield authorities appear to suffer from is that they are the designers of the rifle only. Waltham decides the powder, Woolwich the cartridge. A private inventor would get exactly what is wanted under the last two heads, and would not be subjected to such interference in his design.

so that I am not afraid to say that I would take the oldest form of breech-loading rifle known, and with a good cartridge, properly filled with powder, I will beat the very last introduction with the lowest trajectory, and that without increasing the weight of the bullet, and while decreasing the weight of the powder. To show how much this is the case I may state that only in the beginning of this year the Germans attempted to make a new description of powder for rifles, and they found that they could get effects with 47 or 48 grains of powder rather superior to what they got with 75 grains before—that is with powder properly made. Mr. Nordenfelt has found that that is the case in his machine-gun, that a certain arrangement of powders known many centuries before the era of modern rifles immediately produces a range nearly double in extent and with corresponding velocity. In these circumstances, it is not worth while in all these investigations not to be bound by that most fatal of all errors which investigators can commit—the adoption of a formula which does not include all the conditions of the problem in hand. It is quite true you may get a bullet that will offer the least resistance to the air, and possibly with a very long range, if it were a weighty material, or, in other words, had a high specific gravity on the formula of $\frac{D^2}{W}$; but in such a case do you fulfil the other

conditions? First of all, do you unduly elongate the cartridge, and therefore introduce enormous difficulties, because the instant you do so you must have a longer breech-block and you must throw away more of the barrel. It seems from Colonel Arbutnot's paper that, while the rifles are put at 33 inches of barrel, no account is taken of the different methods of breech-loading, which may make a difference of 3 or 4 inches at least. Another question not less important is that of the diameter of the cartridge as applied to all our existing rifles and machine-guns. It is said, "Line up the rifle," but practically you will find in any rifle or in any machine-gun, if you adopt a different calibre, no matter how you "line up the rifle," you will have an enormous difficulty, not only in the supply of multiplied forms of cartridges, but in the arrangement of the internal mechanism, which must be changed altogether. All this is a very serious matter. I urge, therefore, that the utmost attention should be paid, as Colonel Brackenbury said, firstly, to the "spirit of artillery"—the powder; secondly, to the bullet; thirdly, to the cartridge; and lastly, to the rifle. It is now nearly twenty years ago since I drew the attention of this Institution to the value of solid-drawn metallic cartridges. It has taken twenty years to bring out that fact, and now I suppose we shall wait for another twenty years for the best prepared powder. It takes about twenty years on the average to convince the British public that it is not good to do a thing the wrong way first; they generally do it, and they mostly suffer. The next question to be raised is, are we going to have this magazine arm, or are we going to have an intervening arm, which, I presume, is to be supplied to the whole army, both in Europe and in India? How long will it take to do it? What is the prospect of getting a magazine arm if this is done, and why should not we have the magazine arm at once? Why on earth are we to pass through an intermediate stage which is acknowledged to be an inefficient stage, and which does not provide any greater supply of cartridges, but rather complicates the greater supply of cartridges by introducing a new cartridge? Why should not we occupy the time in settling really the question upon the basis of scientific investigation such as I have described, instead of putting into the hands of the troops a new arm which will require new drill and a new set of experiments all over the world to establish its value, and which perpetuates the evils attending the extraction of the cartridge. To pass from that to the bayonet: I should like to ascertain, if possible, when and why the bayonet was made two inches longer, because I can recollect the time in my early experience when I was told distinctly that, in view of the constant fact that the ends of bayonet sheaths will come off in long service, the bayonet length had been settled, because it was the length which a man could double at without sticking the end of the bayonet which was exposed into his calves. I know we have now a steel sheath, but that is almost as bad in this and other ways. I believe the length of the bayonet was increased to that extent, and that it was found necessary to do so in order to make up the length of the barrel to the proper length desirable for thrusting with the bayonet point, and I think, in doing so, that some former experience has been forgotten. It seems to me that our

bayonet sheaths in long service are sure to be liable to the same objection as was formerly raised. I also think that you might do away with the ramrod altogether and might substitute a more useful thing. I do not think that the bayonets should be used to dig with, but I do think that there is an enormous advantage in suppressing every ounce of weight in favour of cartridges. If you can take away one pound of weight and give the men ten additional cartridges, so much the better. We carry that useless block of weight, the stock of the rifle; what is the good of it? Ought it not to be full of cartridges? These are things that we should like to see carefully examined before we see a little change in the curve of the wood and in the arrangement of the bayonet, which is to be considered sufficient to re-arm the troops of Great Britain. Above all, it should not be done under the influence of reports made on previously defined and limited lines. The essence of a good and sound report is that it shall be a report on the action of facts ascertained in your own knowledge. I do not care for a formal report which has certain lines which you must answer, and leaves out altogether certain other lines which you might answer, but which you do not find called for in the report. I say that that is not a report such as the country ought to rely on. It has been the system which has been adopted, but in my opinion it is a very wrong system. No doubt the truth will and has come out on active service, but that is the very last place where we should like it to come out. I therefore deprecate any attempt to solve this question by such a system as is now being acted on, for I am quite sure it can only lead to continued error such as we have seen in the past, and such as we shall again uselessly regret in the future.

Colonel WAKE: As Colonel Hope has given you his experience of the War Office, I should like to tell you mine. I took the trouble to make twenty steel cartridges and to drill them out the same bore as the Martini-Henry rifle. Into these cartridges I put 75 grains of powder. I fired them against Martini-Henry cartridges from the same rifle through the platoon screen, and my 75 grains of powder in a uniform bore gave exactly the same muzzle velocity as 85 grains used in the bottle-nose cartridge. The bottle-nose cartridge, as it is shown here from the larger base with the gas acting down the barrel, gives ever so much more recoil than if the cartridge were uniform in form. Colonel Arbuthnot does not tell us the difference of recoil as between our rifles and foreign rifles. Now I am positive that anybody who has had anything to do with shooting knows that the question of recoil is one of the most serious difficulties you encounter in teaching young soldiers. Neither does he tell us, if I remember rightly, what is the weight of ten rounds of this new ammunition. I believe, from working at it, that it is heavier than the Boxer, therefore, in carrying sixty rounds, which with the old cartridge weigh 6 lbs., he has now to carry 7 lbs. With the new rifle that is to be brought out, I certainly think he ought to be able to carry ninety rounds without carrying any more weight, and I am certain that such a result would meet the approval of Officers who have seen active service.

Colonel ARBUTHNOT: The recoil of the new rifle is to all intents and purposes *nil* at the man's shoulder, because the bullet is 100 grains less in weight. As regards the weight, seventy rounds of ammunition will be carried.

Colonel WAKE: I should like also to be told the actual figure of merit of the diagrams that are shown, because, unless the figure of merit is worked out, it is impossible to make a comparison of that shooting with the shooting of other rifles.

Colonel ARBUTHNOT: The figure of merit is marked on the plan.

Major KITCHENER: Captain James has mentioned that the Austrians are about to introduce a magazine rifle. I may mention that yesterday I saw in Pall Mall the authorized field pattern of the German magazine rifle as adopted by them. It contains eight cartridges, and a very ingenious contrivance for closing the magazine so as to use it as an ordinary rifle. The new cartridge comes up and the old one is ejected by a simple movement of the hand.

Captain LUMLEY: I do not want to add much to this discussion. An attack has been made upon Mr. Childers for what he did. I think Mr. Childers spoke more as a statesman and economist than as a General. And I think also Mr. Childers had a very good precedent for what he has done, because we know on the highest authority—German and French—that they have already decided on adopting a repeating

rifle; and the only reason why it has not been carried out is an economical one, arising from the expense that will be incurred. I have no doubt that is the reason why Mr. Childers decided in the same way.

Captain JAMES: I should like to be allowed to explain that I did not mean personally to attack Mr. Childers. I should think it unbecoming on my part to do so, especially as he was sheltered behind that very strong iron-plated target, the Secretary of State for War. I merely wished to draw attention to the fact that in this case we knew what we do not often know, who the Secretary of State really was. Captain Lumley says that the Germans are going to introduce a repeating rifle; it seems to me *raison de plus* why we should not have this intermediate step typified by the Martini-Enfield.

Mr. HENRY WHITEHEAD: I should like to say a word about the block. There is one point that is very important. With the Martini breech-loader, we cannot see through the barrel clearly, neither can we clean it out from the breech,—a very important thing with all rifles. I have had very little opportunity of seeing the new rifle, but there is one objection to it, and that is the wooden shield. I am sure on active service that would very soon get broken. The same object might be attained by putting a piece of strong leather over the barrel. I can only endorse every word that Sir Henry Halford said about the grooving. I am sure there is no comparison between the ratchet and the segmental. I say that with some little experience, for I have shot with nearly every English rifle brought out within the last 27 years. I should like to suggest whether in an experiment like the present it would not be better to send out say 100 rifles, not only to the best shots in the army, but also to the Volunteers, and not only to the Volunteers in England, but also to the rifle shots in India and our Colonies. Let us get their experience not only in the English climate, but in every climate. Many Volunteers have their own private range, they have every opportunity of testing rifles thoroughly, and I am sure a little of their experience would be of very great service. I can also endorse what has been said about having this rifle as a kind of stop-gap,—it is nothing more nor less. If we are to have magazine guns, let us have them at once.

Colonel SLADE: Sir Archibald Alison, I should like to say a few words on two points. I think the gravest objection to the Martini action has not been stated, and that is, with the prospect of the introduction of a magazine arm at no distant date, the mechanical impossibility of adapting the Martini action to a magazine weapon; and so, by perpetuating the Martini action for the Services, we have, so to say, on account of the great expense,—that would be the reason urged against another change,—put off the introduction of a magazine arm for possibly from 10 to 15 years. I do not pretend to touch upon any manufacturing details, because they have been dealt with so ably by other gentlemen who have spoken, but I have always thought that the mechanical impossibility of adapting the repeating or magazine system to the Martini action should have prevented us from perpetuating that action. There is one other point, and that is the quick-loader. Colonel Arbuthnot is a manufacturer, and he has turned out an extremely ingenious quick-loader, but I want to know where our young soldier is to carry it. When he has his valise and great-coat, his pouches, side-arm, haversack, and water-bottle, there is absolutely not room to hang a fourpenny piece on him anywhere,—he is not large enough. It would be a very awkward thing to carry a quick-loader of that nature permanently attached to a rifle, and if you do not carry it permanently attached you must carry it on the soldier's person, and I have looked at soldiers in marching order and tried to find out a place where to put it in vain. I think the only suggestion made was that he could slip it in his pocket. I think, probably, seeing that he sometimes has to sleep in his clothes, he would not carry it long, but would throw it away. Personally I strongly object to having a metal quick-loader of that description. It would add very little to the quickness of loading, it would be highly inconvenient to carry, and it also adds to the weight of the arm, and would burthen the soldier with an additional article to look after and carry.

Colonel ARBUTHNOT, in reply, said: The chief point raised by nearly every speaker has been the condemnation of the Martini action. I do not wish to say anything either for or against the Martini action, it has nothing to do with me, and,

in describing this new rifle as compared with foreign arms, I have done so more with regard to the power of the rifle as a military weapon than to the particular means of closing the breech. After all, that has nothing to do with what a rifle will do; what the rifle can do depends upon the cartridge and barrel. The same cartridge can be adapted to a magazine arm, whatever breech action you have behind it. And as to saying that, by manufacturing this arm, you perpetuate the Martini action, that is not necessarily the case, because, whatever magazine arm is to be adopted, whenever that is determined upon, the new barrels and a great part of the rifle can be put on to the new action, whatever it is; the question of the magazine and breech has nothing whatever to do with the barrel,—they are totally distinct questions. And, as we must have made rifles of some sort, it seems to me it is best to go on with a rifle which we know is not a bad one rather than make no rifles at all, waiting till the question of the magazine arm is decided, for that is what it would amount to. With regard to the magazine arm, I have not said a word about magazine rifles in this lecture, because it is a lecture on single-loading rifles. When the time comes, and when the magazine arms are out for trial, I shall be quite prepared, if it meets with the wish of the Council of the Institution, to read another paper on magazine arms in which I will deal with the different patterns which are in use in Europe, and which have been presented to the Committee in this country for trial. It may not be generally known that the Committee on magazine arms, of which Sir Henry Halford and Colonel Slade are both members, has been sitting for nearly three years, and it has recommended two rifles for trial which are at this moment in process of manufacture, 2,000 for the Navy and 300 for the Army. The Navy undoubtedly will adopt a magazine rifle, and I have not the smallest doubt in the world that before a couple of years are out the magazine rifle will be in use in our Navy. Therefore, I do not think the introduction of the new arm can be looked upon in the light of a stop-gap, and it will not delay the introduction of the magazine rifle by one single day. The magazine rifle which we have recommended—and no doubt Sir Henry Halford and Colonel Slade will bear me out in this—is superior to any magazine rifle in Europe or America with which we are acquainted. I do not wish to argue the point as to whether what I said in my lecture, that the Martini-Henry, at the time of its adoption, was the best military rifle in Europe, is strictly correct. I meant that it was the best Service rifle. I did not mean to say there was not a better rifle in existence at Wimbledon, and I do not wish to argue that particular point. With regard to the trajectory which Sir Henry Halford spoke about as being compiled by Bashforth's tables and not by Metford's, that is a question which does not affect me or Enfield at all. Those are things laid down by authority. Bashforth's at present is the authorized formula to be used in calculating trajectory; whether he be right or wrong has nothing to do with me. All these trajectories are compiled according to Bashforth's tables, and if the Metford gives a better trajectory than the Bashforth, so much the better for the rifle. As to the form of the grooves, I am not at all wedded to any particular pattern, but in introducing this pattern we had to be governed partly by the question of repair of old arms. We are making rifles now for experiment with the Metford grooving, and if it be found to be better in hot climates I shall be the last to wish to see the form now used in the new rifle kept up. That is simply a question of trial, it does not affect the shooting a bit. All that is wanted is to make the bullet spin and to keep the rifle clean. The best form of groove to do that certainly ought to be adopted, and if the Metford turns out to be the best, it will be adopted. I am sorry that Sir Henry should accuse me of want of courtesy in not saying that the idea of putting the bullet into a cartridge by pressure was Mr. Metford's invention. I hardly think he was justified in saying that. I certainly did not wish to take claim for a thing that we had not invented at Enfield, and if I did not say who was the inventor it was simply because I did not know. I did not get the idea from Sir Henry Halford; I got it from the Americans, who have put their bullets in by pressure for a long time. I may also add that we do not make cartridges at Enfield.

Sir HENRY HALFORD: I did not for a moment suggest that Colonel Arbuthnot kept it back wilfully; I only wished that attention should be drawn to it. The invention was distinctly first made by Mr. Metford, and it was pointed out by me to

Colonel Arbuthnot. He might have heard of it before, but I had great work to get this system adopted amidst great opposition.

Colonel ARBUTHNOT: I think reference has been made to the question of the steel cartridge case, and to the additional velocity gained thereby. The real reason for that is that it fits the chamber more closely, because in the Boxer cartridge there is a very large air space, and consequently a great deal of pressure, when the powder is ignited, is taken up in swelling out the cartridge to the walls of the chamber. I do not think the fact that the cartridge being made of steel or brass, if it fits accurately to the chamber, would affect the question of velocity one bit. If the cartridge is filled up entirely by the powder, and the whole force of the powder is exerted in expelling the bullet and not swelling out the cartridge case, you will undoubtedly get a higher velocity than you will when part of the force of your powder is taken up in doing work which it is not supposed to do,—that is, swelling out the cartridge case. If you have a big chamber and a small cartridge, you lose velocity.

Colonel WAKE: That is hardly proved, because the Boxer cartridge will give quite as high a velocity as a brass-drawn one. I have tried it myself, and I have seen it tried many times with the Gatling.

Colonel ARBUTHNOT: The Gatling cartridge gives 50 feet more velocity than the Service cartridge,—that is a well-known fact,—it has a smaller chamber. What Admiral Selwyn says about the powder is quite true. If we can get a better powder, no doubt we shall get the same velocity with a smaller charge; but I do not think that the rifle should necessarily be kept back until we have got a better powder. The barrel will do just as well when we have invented a better powder. A new powder will always give a higher velocity than an old one, but in our conditions of service, when cartridges may be made nine or ten years before they are used, we must have a good keeping powder. Our conditions are not so easy as those of foreign countries which have no Colonies. Our soldiers are called upon to fight in every climate, almost from the Arctic regions to the tropics, in wet, cold, drought, heat, and every sort of condition, and our magazines are all over the world,—in wet places like the West Indies and the Mediterranean, and in dry places like the Punjaub,—so that we must have a good keeping powder. It is not so easy to get a strong powder which will also be a good keeping powder; and it is far more disadvantageous to have a powder that, after being made five or six years, gives very bad results than to have a powder which gives a little less good results at starting, but will maintain those results as long as the cartridge remains in store.

Admiral SELWYN: I did not refer to any different powder to what we have now got—it is the proper mixture of the best powder.

Colonel ARBUTHNOT: I am sure, if the authorities at Waltham Abbey will give me a better powder, I shall only be too delighted to have such a powder as gives better results. It is a thing that I am always asking for myself, but I cannot get it. I should have thought, although the men of our Army are very much cumbered with water-bottles and what not, that they could find room for a small article of furniture like the "quick-loader." It is only meant for outpost duty, sentry work, and so forth, to give the soldier facility for loading without having to fumble at his pouch when his fingers are frosty or wet. It is simply to help him to load quickly; it is not meant for anything else: it is not meant to take the place of the magazine. I am very pleased that nearly all the discussion has been directed to the abuse of the Martini action, and very little to the abuse of the power of the new rifle, and I am very glad to think, as far as I have been able to explain it, that it has met with the approval of those Officers who have listened to my remarks.

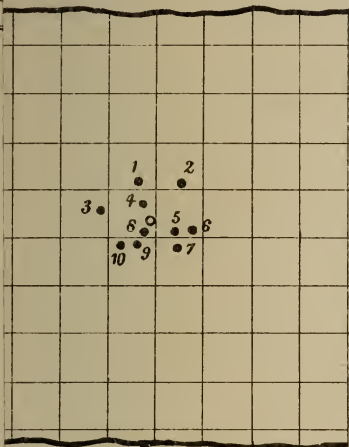
The CHAIRMAN (Sir A. Alison): I think that this discussion has been a very interesting one, and it has brought forward a great many important points. It has taken, perhaps, a larger range than was quite justified by the lecture, and has extended into matters which were rather beyond its scope; but it was both varied and suggestive; and I am sure will have done good by directing attention to the subject generally. There is one point which I feel very strongly about, and it is this. We have heard a great deal as to waiting until we have got the most perfect weapon, until we have secured a perfect breech-loader, before we make a change. Well, gentlemen, I entirely go

against this. We are a very great Empire, and we have got a very small Army. We have connections and interests in every part of the world: we may at any moment be brought into a state of war with another country which can put larger armies into the field than we can, and our only chance of success is that our Army, small as it is, should be composed of men better equipped, better, if possible, in discipline, and infinitely better certainly in arms. Hardly a year ago we were on the edge of a war with a Great Power, and we had a weapon inferior to that which would have been brought against us. Now, to those who have had anything to do with matters of that kind, this is a most appalling state of things. At whatever risk, at whatever sacrifice, our only chance is always to keep our armament, at least, ahead of other nations. We cannot compete with many States in numbers; but we have greater wealth than any; and it will be a shame and a disgrace to the British name if we ever go down with a crash because we have grudged the money necessary to arm our soldiers with the best of weapons. As far as things have gone, I think there seems a general consensus of opinion that the barrel of the new weapon is an admirable one, and that when our soldiers get it into their hands they will have the best military weapon with which at this moment any of the Great Powers of Europe are armed. Now I think that is a matter of enormous consequence. Let us by all means get a perfect breech-loading rifle the moment we can; but do not let us lie defenceless in the meanwhile, waiting for a perfection which has not yet been attained. I am happy to hear from Colonel Arbuthnot, what I did not previously know, that the new barrel can, if necessary, be used in a repeating rifle. This is a matter of great importance because, should a repeating rifle ever come generally into use, it will enable the change to be made at a comparatively small cost. The discussion has been a valuable one, and I hope will attract public attention to some of the points which have been brought before us. I am sure you will agree with me in thinking that the lecture itself was an admirable one, well put together, clearly expressed, and containing much and most useful information in a small space, and that, therefore, you will join with me in giving our very best thanks to Colonel Arbuthnot for having brought so important a subject before us in so interesting a form.

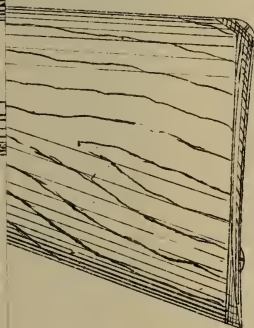
ENFIELD MART

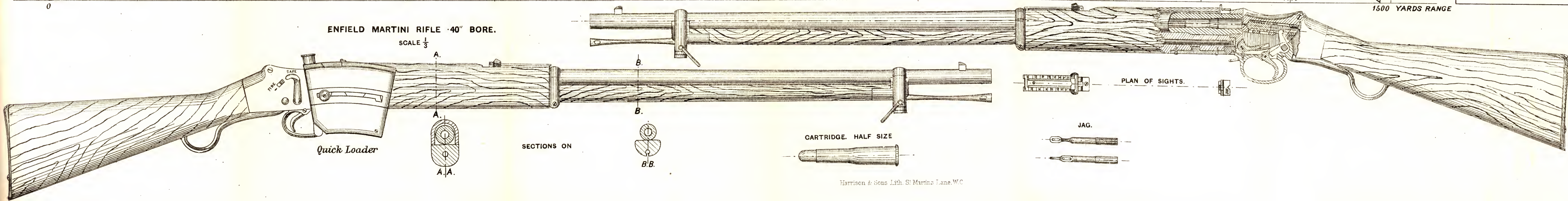
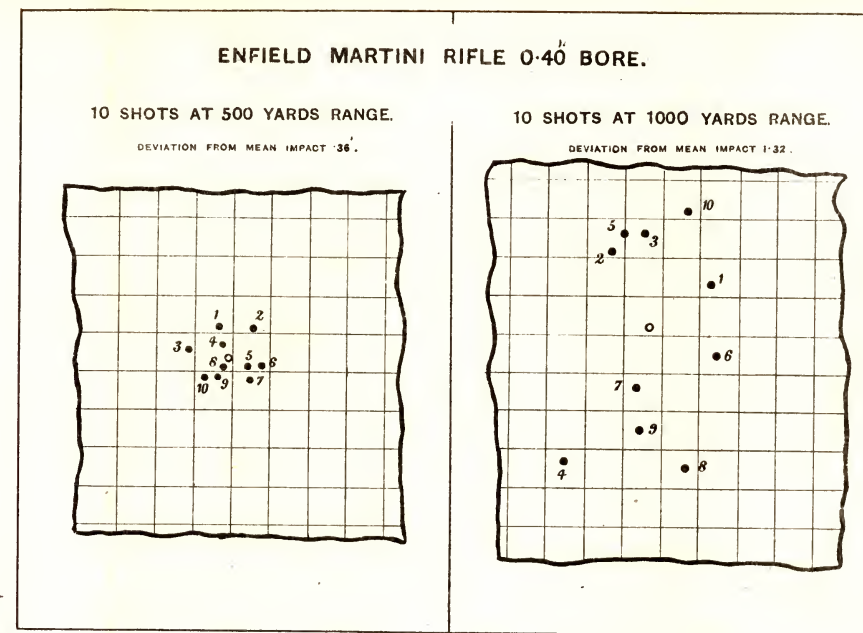
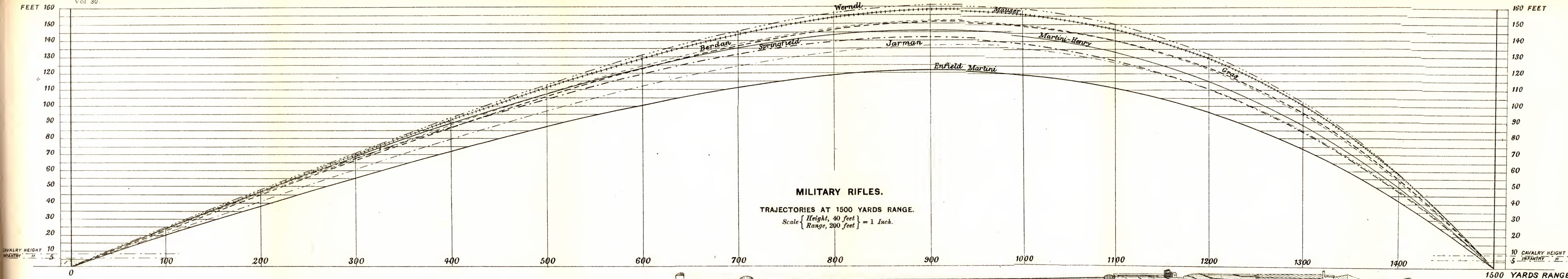
SHOTS AT 500 YARDS RANGE

DEVIATION FROM MEAN IMPACT .36.



1100





FEET
50

40

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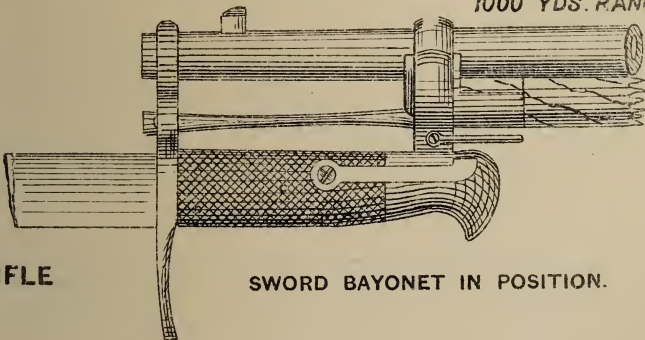
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CAVALRY HEIGHT

INFANTRY "

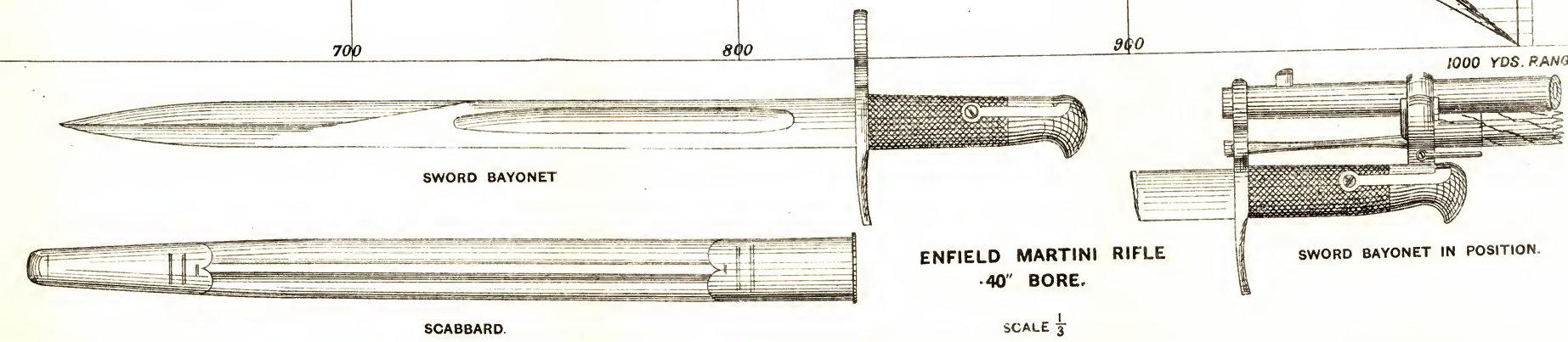
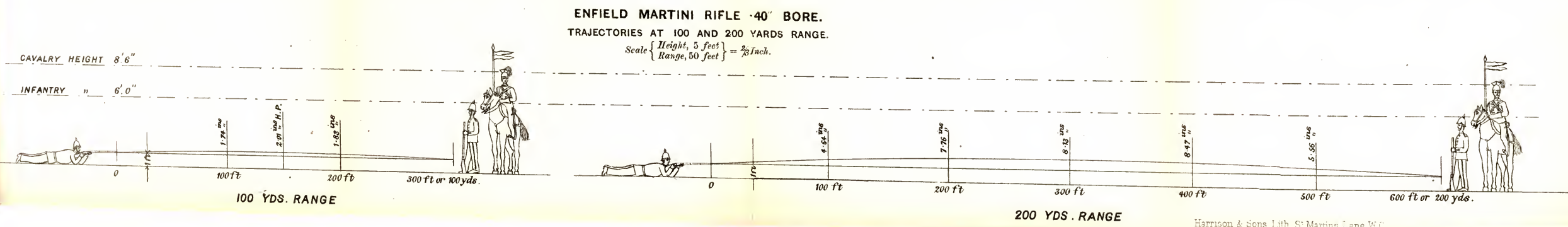
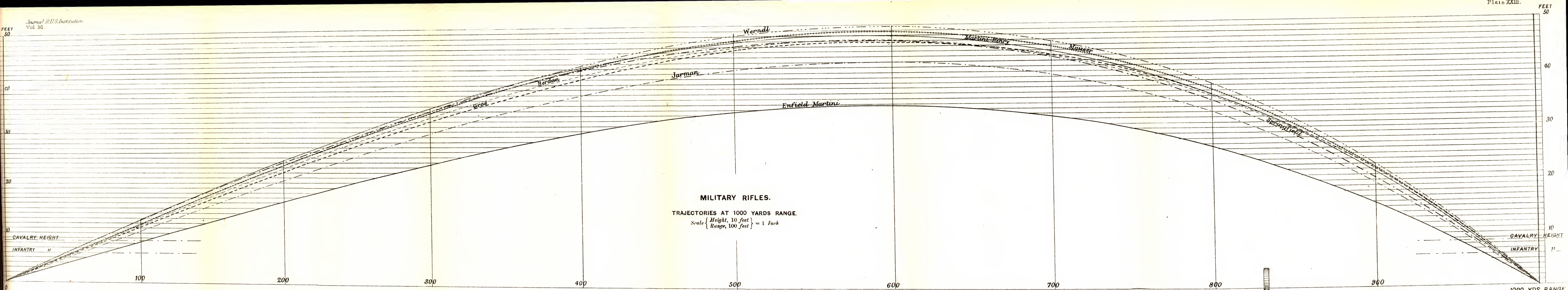
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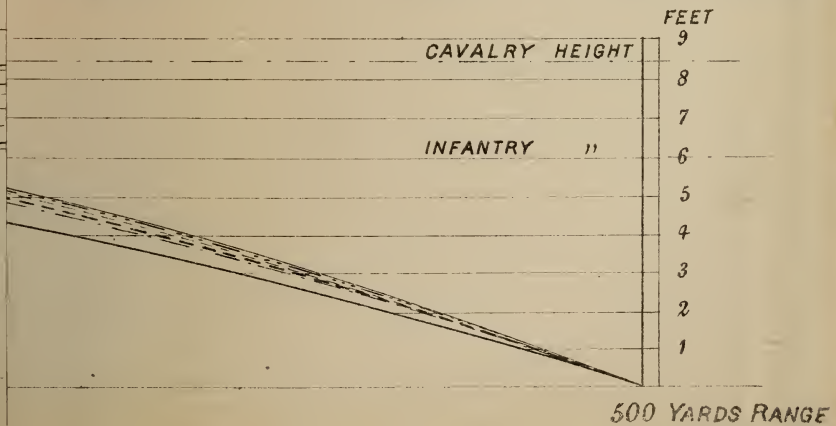
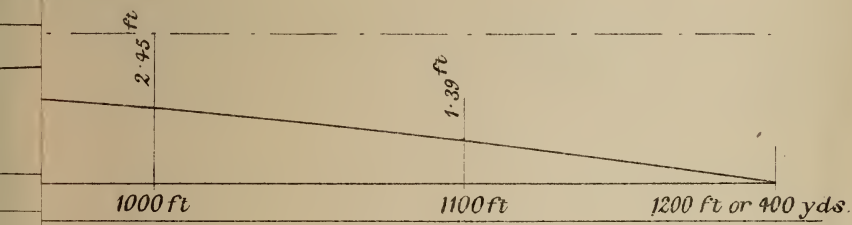
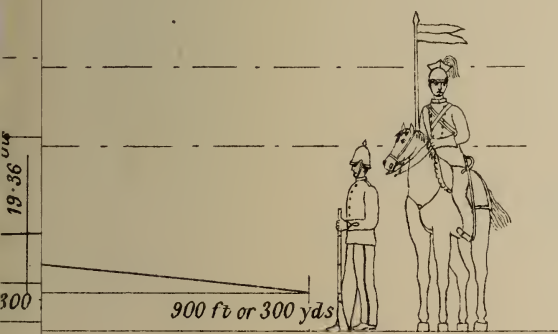
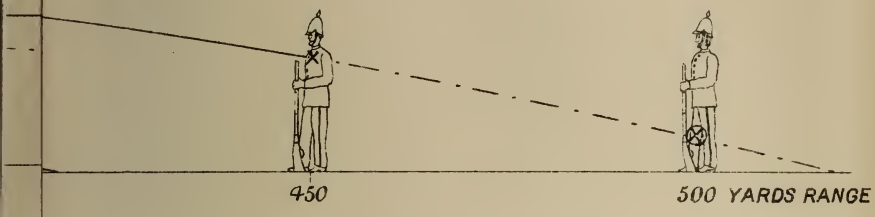
1000 YDS. RANGE



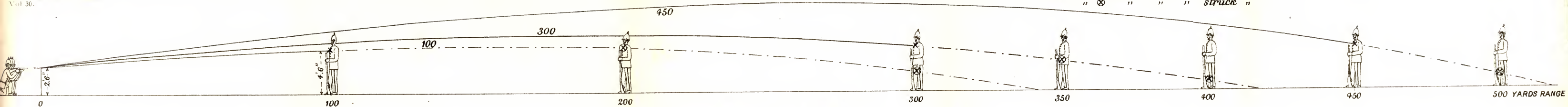
RIFLE

SWORD BAYONET IN POSITION.



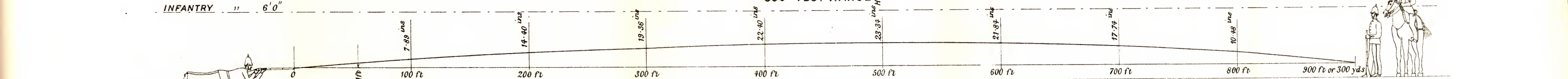


Note, - The x denotes the point aimed at.
" ⊗ " " " struck "

$$\text{Scale} \left\{ \begin{array}{l} \text{Height, } 7.5 \text{ feet} \\ \text{Range, } 75 \text{ feet} \end{array} \right\} = 1 \text{ Inch.}$$

$$\text{Scale} \left\{ \begin{array}{l} \text{Height, 5 feet} \\ \text{Range, 50 feet} \end{array} \right\} = \frac{4}{5} \text{ Inch.}$$

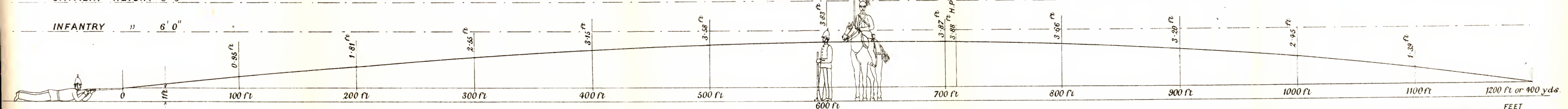
INFANTRY " 6' 0"

300 YDS. RANGE



INFANTRY " 6' 0"

400 YDS. RANGE



CAVALRY HEIGHTS

INFANTRY

$$\text{Scale} \left\{ \begin{array}{l} \text{Height, 5 feet} \\ \text{Range, 75 feet} \end{array} \right\} = 1 \text{ Inch.}$$

Werndl and Mauser

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Springfield & Martini-Henry

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Harrison & Sons Lith. St. Martins Lane W.C.

500 YARDS RANGE

Friday, June 18, 1886.

MAJOR-GENERAL SIR PETER S. LUMSDEN, G.C.B., C.S.I.,
Bengal S.C., in the Chair.

ON THE USE OF PETROLEUM AS FUEL IN STEAMSHIPS
AND LOCOMOTIVES, BASED ON ITS EMPLOYMENT IN
THAT WAY ON THE CASPIAN SEA AND IN THE
TRANS-CASPIAN REGION.

By Colonel C. E. STEWART, C.B., C.M.G., C.I.E., Bengal
Staff Corps.

Colonel STEWART: I have just returned from Baku, on the Caspian Sea, where I was employed by the London Chamber of Commerce and the Petroleum Association to attend a Conference on the subject of petroleum that had been assembled at Baku by the Russian Government. I am perfectly well aware that experiments have been made, and successful experiments too, on the use of petroleum as fuel in England, but my remarks are based entirely upon what has been done in Russia. The Russians have advanced beyond the experimental stage, and have actually used petroleum fuel in a very large measure in their mercantile marine and navy.

THE subject of the paper which I am about to read to you is one in which I have been much interested for many years. I visited Baku, on the Caspian Sea, the headquarters of the petroleum industry of Russia, first in 1866, twenty years ago. I then carefully inspected the petroleum refineries, which at that time were only two in number, though now they are nearly one hundred. In 1866 there were very few railways in Russia, and the difficulty of reaching the Caspian Sea was considerable. On that occasion I spent six months' furlough from my regiment in India in riding from the Persian Gulf to the Caspian Sea, and, after visiting Baku, went up the Volga to the fair at Nijni-Novgorod, and then travelled to England by Moscow and St. Petersburg. At present this is a very easy journey, often adopted by travellers from India, but at that time it was by no means so easy.

A trip from London to Baku can now be taken without any difficulty by rail to Odessa and then across the Black Sea to Batoum, and from Batoum to Baku *viâ* Tiflis by railroad. Otherwise by rail to Vladikavkaz at the foot of the Caucasus, then by diligence over the Darial Pass to Tiflis, then by train to Baku. This is the quickest way, and can be accomplished in ten days, while the journey by Odessa takes at least eleven. Another road is by rail to Zaritzin, on the

Volga, then down the Volga to Astrakhan by river steamer, and then on to Baku by Caspian Sea steamer. I have visited the petroleum districts of Baku nine times during the last twenty years, and have travelled not only by all these three routes, but by several others which are not so short.

On my first visit to Baku the Russian steamers on the Caspian burnt coal, which was most expensive, and this was eked out by using a composite fuel, which was composed of coal-dust mixed with petroleum refuse and shaped in a mould. The quantity of this fuel that was available was small, as the amount of coal-dust procurable was limited. Several efforts were made to burn either crude petroleum or else astatki, which is the refuse left after the more volatile oils have been distilled off from crude petroleum. The first efforts in this direction were not successful, but the difficulties were finally overcome, and for the last twelve years astatki has been burnt in most of the steamers running on the Caspian Sea or the Volga River. I have no exact return of the number of vessels in which astatki is used on the Volga and Caspian Sea, but the number, including small tugs and steam launches, cannot, I believe, be put down at less than 200. All factories and refineries at Baku, which are very numerous, being nearly 100 in number, burn astatki as fuel for the heating of their steam boilers. The small steam-engines working the 157 wells which at present produce oil in the neighbourhood of Baku are also all heated either with crude oil or astatki. Besides this, the very numerous factories at Zaritzin and other places on the Volga use this fuel, and also some factories at Moscow, and at least one at St. Petersburg.

On the Trans-Caucasian Railway the locomotives use astatki, as do also the locomotives on the Zaritzin-Grazi line, having its terminus on the Volga. The locomotives of the Trans-Caspian railroad from Michaeloff, on the Caspian, to Merv, also burn nothing else, a million poods, at 36 lbs. each pood, having been supplied last year for the use of this railroad. The cleanliness and safety of petroleum refuse as fuel has been abundantly demonstrated, and I have only heard of one accident, where a fireman was much burnt in trying to cleanse the pulverizer of a steam-engine which had been choked while the pulverizer was in actual use, and this was due to carelessness on the fireman's part.

Great ignorance seems to prevail in England in regard to the petroleum refuse burnt in Russia under the name of astatki, and extraordinary ideas as to its inflammability seem to prevail. Of course crude petroleum as taken from the well is a highly inflammable substance, and would be dangerous to burn on board ship. I will therefore proceed to describe exactly what is known in Russia as astatki. When the crude oil is taken from the wells at Balakhana, situated some 8 miles from the port of Baku, on the Caspian Sea, it is first pumped into shallow basins, where it stands for a short time to deposit the sand, with which it is largely mixed. It should not be allowed to stand long, as the heat of the sun causes the evaporation of its more volatile particles, but it should be pumped into closed

reservoirs, and is then delivered by the pipe lines (of which there are twelve belonging to different Companies) to the refineries situated on the Bay of Baku. This crude oil is then run into great iron boilers containing from 200 to 3,000 poods each, and is distilled either by fire alone, or else, which is the preferable method, superheated steam is introduced into the boiler, while the outside of the boiler is at the same time heated by the direct action of a petroleum fire. At first the volatile oils, known under the names of benzene and gasolene, are taken off. These, especially benzene, are highly dangerous and inflammable substances. At Baku most of the benzene is got rid of by running it into the sea, though a small quantity, enclosed in iron casks, is forwarded to Russia by the Volga for detergent purposes. The gasolene is not exported, but is used in the Baku district itself as fuel, especially in iron works. After the benzene and gasolene have been distilled off, kerosene, a much less inflammable oil, is taken off by distillation, and also solar oil, which is still less inflammable. The Baku practice is to consider all oil between 0.780 and 0.860 specific gravity (water being taken as 1) as kerosene. This is a much higher specific gravity than American oil. The distilled oil having a specific gravity between 0.860 and 0.880 is known at Baku as solar oil. All refuse having a higher specific gravity than 0.880 is run off into the *astatki* or refuse tank. This is the substance adapted for burning in locomotives and in the furnaces of marine boilers, and should alone be used. Some Russian *astatki* has a specific gravity of 0.910, and occasionally even higher.

It will be observed how much of the inflammable portion of the original crude petroleum has been taken off, and thus *astatki* can be carried with perfect safety in the hottest climate. The burning point of ordinary Baku *astatki* is about 422° F.

A very reprehensible practice obtains with the more unscrupulous dealers. If they have a flowing well and the quantity of petroleum thrown up by it has been more than they could either refine or sell, and the crude oil has remained some time exposed to the air in the lakes or ponds which surround the wells, and has from long exposure become unfit for refining, they run this crude oil, which is known as lake oil, into their *astatki* tank. As crude oil contains a large proportion of volatile oils, this practice is most objectionable. It is, however, easily discovered by a very simple test, and the taking on board a steamer of *astatki* thus adulterated can be guarded against.

Besides this adulteration by the mixture of crude petroleum with the legitimate *astatki*, another adulteration not so objectionable takes place by the admixture of a substance known in Russia as *gudron*. *Gudron* is the residue when *astatki*, which has already given up its more volatile oils, is again mixed with superheated steam and redistilled and made to yield three descriptions of lubricating oils of different specific gravities. The lightest is generally known as spindle oil, then machine oil, and, thirdly, cylinder oil. This last has a specific gravity as high as 0.925. This second residue or *gudron*, having lost so much of its oily constituents, is much less inflammable than ordinary *astatki*, and it is a common practice at Baku to mix

10 to 15 per cent. of gudron with the astatki sold for burning purposes. There is not the same objection to astatki adulterated with gudron as to the astatki adulterated with crude oil. Gudron cannot be burnt by itself, so this mixture is slightly less inflammable than the ordinary refuse; but there is an objection to its use as gudron is very thick and likely to be full of lumps, it is thus apt to clog the pulverizer or burner through which it is driven.

I am aware of the various trials and experiments that have been carried out at Woolwich and at other places in England in the burning of different hydrocarbons as fuel for steam-engines, and also for the heating of iron furnaces, but I wish here strictly to confine myself to what has been accomplished in Russia, because it has been more widely used there than elsewhere with most excellent results. In 1870 a steamer called the "Alexi" was fitted with an apparatus for burning astatki, and was most successful. Mr. Lentz, a very celebrated engineer, who has at present large works at Baku, over which he kindly conducted me, had about the same period invented an improved burner, or pulverizer as it is always called. Mr. Lentz took out a patent for his improved burner, and this, or a modification of it, is now almost universally adopted in steam-engines and locomotives in Russia. I now produce to you the most simple form of burner which is used at Baku. Through a straight pipe ending in a slightly flattened orifice a jet of steam is driven: astatki is allowed to flow from a small tank through a curved pipe and to meet the steam which pulverizes it or divides into fine spray. This fine spray of mixed steam and astatki is driven by the force of the steam jet into the furnace in which a fire of wood or cotton waste has already been kindled. This fire is continually fed by a spray of mixed steam and astatki. It will be observed that it is requisite before starting a steam-engine by this method to get up steam with either a wood or coal fire to supply the steam necessary for using the pulverizer. Of course this is an objection, but it is one that is easily overcome. At Querelle, on the Trans-Caucasian Railroad, where there is a large engine-shed over which I was kindly taken by the engineer in charge, the locomotives which have brought the trains over the sharp gradients higher up the line are changed and fresh engines supplied. As many engines are always ready in waiting, the difficulty of starting the fire is surmounted by one engine always keeping up steam ready to supply the quantity necessary for utilizing the astatki burners, but it would be easy to supply the necessary steam from a small stationary boiler. When borrowed steam is used for starting a locomotive a special arrangement for the transmission of the steam from the locomotive supplying it in the first instance to the injector of the supplied engine has to be added, but this is attained by a very simple apparatus which I need not here describe. I was informed that a pressure of 120 lbs. of steam can be obtained from cold water in about fifty minutes from the first application of steam to the pulverizer, and in about half that time when it was only necessary to raise steam in boilers already containing hot water.

In marine boilers on the Caspian Sea steam is originally got up by

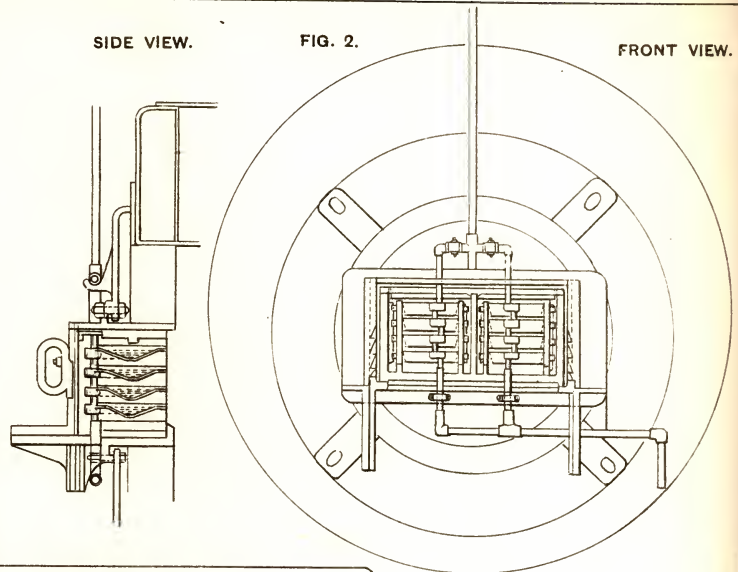
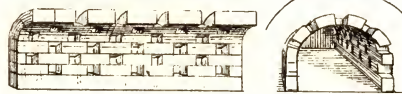


FIG. 5. BRICK TUNNEL.



SIDE VIEW.

FRONT VIEW.

FIG. 3. SIDE VIEW OF MARINE FURNACE.

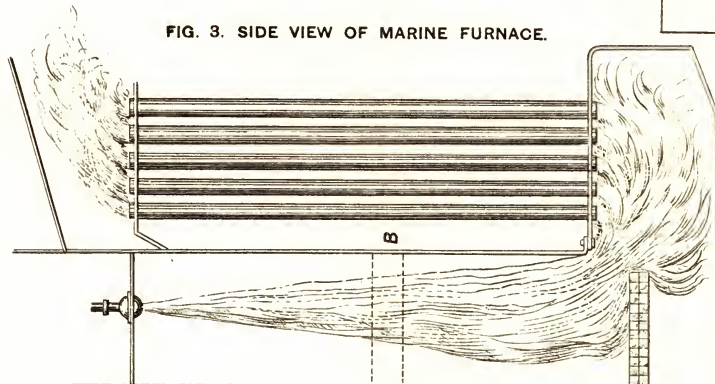
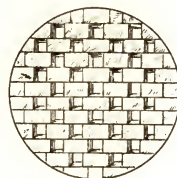
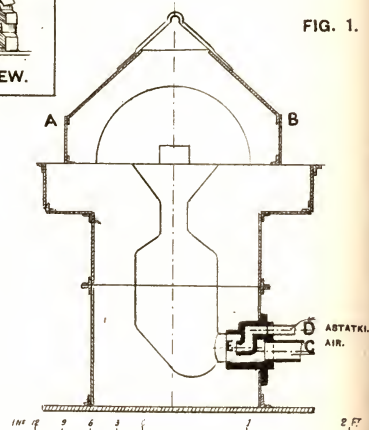


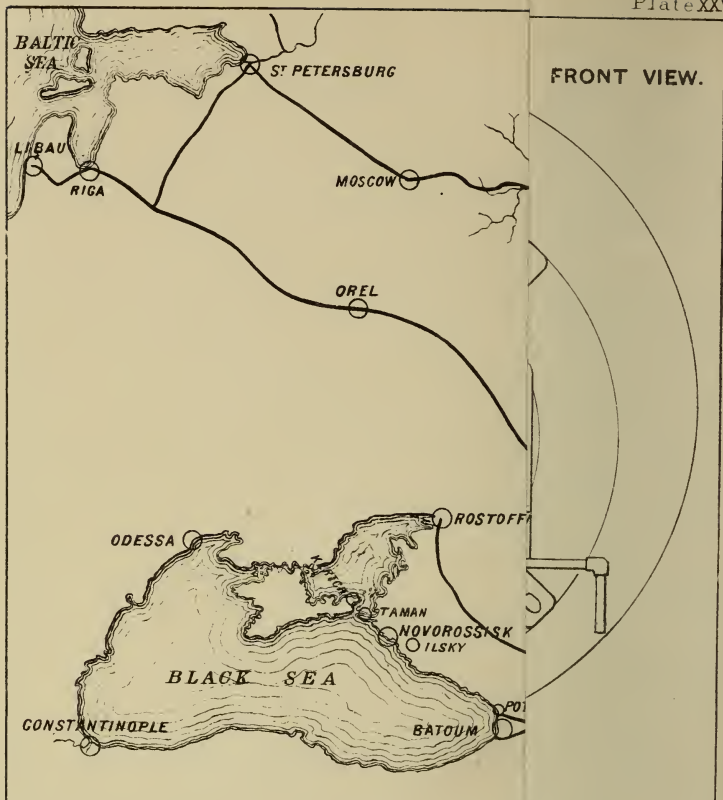
FIG. 4. FRONT VIEW.



VERTICAL FIRE-BRICK PARTITION IN CENTRE
OF FURNACE AT A. B. IN FIG. 3.

FIG. 1.





FRONT VIEW.

FIG. 1.

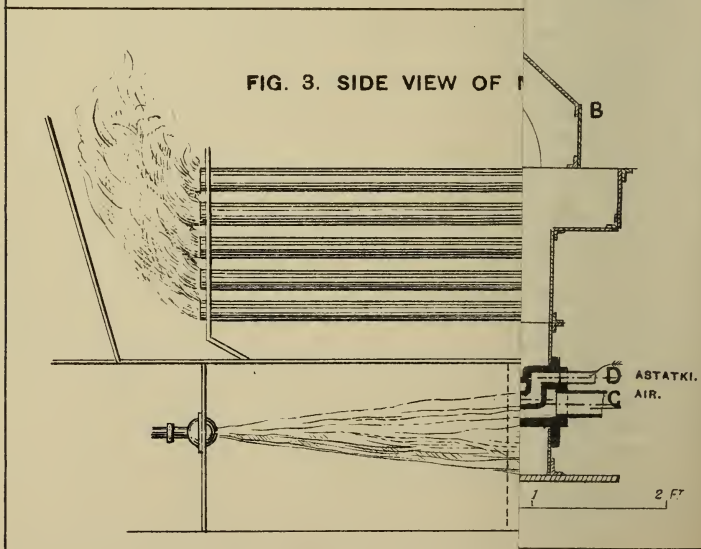


FIG. 3. SIDE VIEW OF

lighting a wood fire which is dispensed with as soon as the necessary amount of steam for utilizing the pulverizer has been obtained. Thus it is only at the commencement of a voyage, when steam has to be got up, that any fuel except *astatki* requires to be used.

The advantages claimed by the Russians in using *astatki* beyond that obtained by the use of the best coal or even of other hydrocarbons than *astatki* are as follows:—That the caloric power of *astatki* is greater than that of any other fuel; that its manipulation is very simple, and that it can be used with complete safety. Thus it is a most convenient and, for them, inexpensive fuel. The price at which it can be delivered, either in tank wagons at Baku railway station or on board vessels in the bay at Baku, does not exceed two shillings and sixpence per ton, and has sometimes been even less than that sum.

Mr. Urquhart of the Grazi-Zaritzin Railroad, on whose line *astatki* has been used for several years with the most complete success, and who is a great authority, states as follows:—

“Comparing naphtha refuse with coal, the former has a theoretical evaporative power of 16·2 lbs. of water per lb. of fuel, and the latter of 12·2 lbs. at an effective pressure of 8 atmos., or 120 lbs. to the square inch; hence petroleum has weight for weight 33 per cent. higher evaporative value than anthracite. Now in locomotive practice a mean evaporation of from 7 to $7\frac{1}{2}$ lbs. of water per lb. of anthracite is about what is generally obtained, thus giving in the case of coal about 60 per cent. of efficiency, while 40 per cent. of the heating power is unavoidably lost. But with petroleum an evaporation of 12·25 lbs. is practically obtained giving $\frac{12\cdot25}{16\cdot2} = 75$ per cent. effi-

ciency. Thus, in the first place, petroleum is theoretically 33 per cent. superior to anthracite in evaporative power; and, secondly, its useful effect is 15 per cent. greater, being 75 per cent. instead of 60 per cent.; while, thirdly, weight for weight, the practical evaporative value of petroleum must be reckoned as at least from $\frac{12\cdot25-7\cdot50}{7\cdot50} =$

63 per cent. to $\frac{12\cdot25-7\cdot00}{7\cdot00} = 75$ per cent. higher than anthracite.”

We may thus consider that 1 ton of *astatki* is equal in practical efficiency for steam generating purposes to about $1\frac{3}{4}$ tons of the best anthracite coal when steam is used for mixing with it in the pulverizer, but it is quite allowed by both Mr. Lentz, the celebrated Russian engineer, and by Mr. Nobel, another great authority on this subject, that though it is cheaper to use steam as the pulverizer, better results are obtained by a jet of air instead of a jet of steam—an apparatus in the nature of a Roots' blower being used for the jet instead of steam. At Mr. Lentz's ironworks at Baku I saw such an apparatus in practical operation for heating large forgings. I here produce a drawing of the furnace in question (Fig. 1, Plate XXV). A blower driven at a very high rate of speed—3,500 revolutions per minute—drives a current of air into the bottom of the furnace through the opening

at C, where it meets a tube, D, E, containing either astatki or else some of the more volatile oils extracted from petroleum. At Baku both gasolene and solar oil being waste products which must be got rid of, are largely used in the ironworks,¹ but it would be of too inflammable a nature for use either in locomotives or marine engines; a similar result is, however, obtained with astatki. The jet of mixed air and gasolene introduced rises to the top of the furnace where it is lighted. This causes a most intense fire, and forgings of considerable size are soon heated to any degree that may be required. A, B is merely a loose iron cover which is placed over the furnace to retain the heat, and is removable at pleasure.

Mr. Nobel, who is the largest refiner of petroleum at Baku, has also an iron foundry at that place. I saw a cylinder for condensing water weighing considerably over a ton that had recently been cast; the fuel employed was astatki. I was present when several castings were made, and saw about half a ton of pig iron reduced to a liquid state in about an hour. Mr. Nobel employs an apparatus in this furnace in which no steam is used, and a strong natural draught of air is utilized in burning the petroleum refuse. The apparatus consists of a series of shallow troughs placed one above the other at the mouth of the furnace, the burning astatki being made to run through a small connecting pipe from the highest to the lowest series of troughs. I here produce before you some of these troughs, and a drawing of an improved apparatus of this sort (see Fig. 2 in diagrams; side and front view is given). With this apparatus the practical result obtained is much better than when steam is used as an injector; $14\frac{1}{2}$ lbs. of water were actually vaporized by 1 lb. of fuel, and it is hoped that even somewhat better results may be obtained; so that we may consider that a ton of astatki used with this trough burner is in practical efficiency equal to nearly two tons of coal.

I will now proceed to consider the question of the quantity of petroleum fuel available in South-Eastern Russia for use in locomotives and marine engines. At Baku there are at this moment 157 wells yielding oil. Of these some twelve are springing wells, which, when in action, throw a column of petroleum into the air to various heights, sometimes only to a few feet above the level of the ground, and others on some occasions throwing a vast column of petroleum into the air to a height of nearly 200 feet. A well at Bibiabad, near Baku, which I visited, belonging to a Tartar whose name has been Russianized into Tagieff, when it was first bored was for a considerable time a springing well. It threw up at the rate of 250,000 poods of 36 lbs. each a day for nine days. A reservoir had been constructed capable of containing 500,000 poods, but after this was filled, the remainder flowed into the sea, and thus more than a million of poods were wasted. At the end of nine days it stopped flowing for a time, but for many weeks it continued to be a flowing well at intervals. At present it is no longer a flowing well, but a pumping well, and produces 10,000 poods a day. The level of the oil in this well was 82 sagines or Russian fathoms of 7 feet each, when

¹ Gasolene was the fuel used when I saw this furnace in use.

the pumping was commenced last year; and though pumping has been continued for a year at the rate of 10,000 poods a day, the level of the oil has not fallen and still stands at 82 sagines.

At Baku ordinary pumps are not used, as the oil is so mixed with sand that the valves of the pump would be very soon destroyed. Instead of this, a valved tube somewhat similar to a sand pump is lowered into the well and drawn up when full by a long rope, worked by a small steam-engine. This tube varies in size and brings up from 15 to 20 poods at each lift. The time required for each operation varies according to the depth of the well, but the one I am especially referring to, used in a well 82 fathoms in depth, was raised and emptied by the steam-engine six times in every five minutes. Some of the flowing wells at Baku have produced enormous quantities of oil, equalling anything I have heard of as produced by a single well in America. The well at present considered to yield the largest quantity of oil at Baku belongs to an Armenian named Awakoff. It is said to have flowed at first at the rate of 300,000 poods a day, but Mr. Nobel has one or two wells which almost, if they do not quite equal it; both his No. 18 and No. 23 having been flowing wells of the very first class. In the neighbourhood of Baku, viz., at Bibiabad, Balakhana, Surukhana, and Binagudi, some 344 wells had been bored up to September, 1885, the latest date to which I have a return. A few more have since been bored. On that date 142 of these wells were giving oil, and 19 new wells were in progress. I believe the number now producing oil is about 157. From these wells last year 103 millions of poods of crude oil were extracted, which is more than 1,690,000 tons, and last year the output was as much restricted as possible in consequence of the very low price ruling for crude oil and its products. The wells are closed with a sliding valve to prevent their flowing at inopportune times, but they very often burst through all restraints. While I was in Baku in April and May last, on several days a well belonging to Messrs. Palaschkowsky, much against the will of its owners, threw up 100,000 poods a day. It is impossible to sell or refine the very large quantities produced by these springing wells. I only mention these facts to show that an almost unlimited supply of petroleum is available at Baku, and if a brisk demand arose, the supply could be greatly increased beyond what was obtained last year.

It must be remembered that besides the supply available from Baku, there are large deposits of petroleum near Novo Rassisk and Taman, on the Black Sea coast, while some petroleum is found near Kertch, in the Crimea. The quantity of refuse fit for burning produced at Baku is very much more considerable in proportion to the crude oil there found than it is in America. In America something like 70 per cent. of kerosene is obtained from the crude oil, while at Baku not more than 30 per cent. of kerosene is obtained, leaving a residue of 70 per cent. of astatki fit for fuel. Also in America the residue is used for other purposes than fuel, viz., for the production of anthracene, naphthalene, and benzol, so that the quantity of residuum available for burning is not comparatively nearly so great as at Baku. Having

shown that the quantity of crude oil that would be available at Baku and at Novo Rassisk is likely to exceed any probable demand for many years, I will now proceed to consider the question of cost relatively to coal. I am prepared to allow that Russian astatki cannot be used as fuel in England at a price which would enable it to compete with coal, if the question of cost alone was considered and all other advantages placed out of sight; but even if the question of price is alone considered, I think astatki could be delivered in Egypt, at Malta, at Cyprus, and especially in the Red Sea, at prices very little above that of coal, allowing that 1 ton of astatki is equal to $1\frac{3}{4}$ tons of coal in steam-generating power. The price of astatki at Baku is at present about 2s. 4d. to 2s. 6d. a ton, but as it has to be carried in tank cars to Batoum, on the Black Sea, a distance of over 500 miles, the price delivered on board ship at Batoum at the present time is about 25s. a ton, while at Novo Rassisk it can be procured at about 22s. The quantity, however, procurable at Novo Rassisk, though considerable, would soon be exhausted if a large demand arose.

If a pipe line were constructed from Baku to Batoum (a project which is at present under the consideration of the Russian Minister for Crown Domains), the cost of transport would be considerably reduced, and it could then probably be delivered on board ship at Batoum at about 17s. per ton. If conveyed in tank steamers, the cost of transit to Egypt or Malta would not be great, and it could then compete at those places very successfully with coal. Among the advantages which astatki has over coal may be mentioned that the stowage space required is rather less than that required for coal, and that it can be stowed in spaces that would not be available as coal bunkers, viz., in the tanks usually filled with water ballast. Besides these there is the great advantage of cleanliness; there is no ash or refuse of any sort to get rid of, and it requires no stoking or attention. In fact Russian steamers running from port to port on the Caspian Sea, after having started their fires, these practically require no attention till the end of the voyage, and thus the services of stokers are almost dispensed with. On the Caspian Sea steamers only such a number of men are employed as are necessary to keep the machinery clean. An engineer is of course necessary to watch the steam, &c., but the firing really requires no attention. A properly arranged astatki fire is also almost, if not quite, smokeless. Plenty of smoke can be seen issuing from the chimneys of the older refineries at Baku, but this is sheer carelessness and waste. In the White Town, near Baku, where the newer refineries are situated, and especially at the factory at Novo Rassisk, where a good system of burning is adopted, there is hardly any smoke. The appearance of smoke is a sign that a waste of fuel is taking place, and is at once obviated by a slight adjustment of the pulverizer, or a small change in the draught. I need not point out how great an advantage it would be in action to have no smoke from the furnaces, and though I am aware that when Welsh coal is used the quantity of smoke is considerably reduced, still the smoke produced, even by the best Welsh coal, is very much greater than in a properly arranged astatki furnace.

At Baku differently arranged furnaces are used in the marine engines, but the most usual and the most simple is the following. When it is proposed to convert a coal-burning furnace into an astatki-burning furnace the fire-bars are taken out, as they are no longer required, and a vertical fire-brick partition is built about the centre of the furnace (*vide* Fig. 4). This fire-brick partition has many openings in it, each opening being the size of one brick, the openings are left for the passage of the flame through the partition. This brick division retains the heat, and cannot well be dispensed with. A low brick wall is also sometimes placed at the end of the furnace. An alteration has also to be made in the door of the furnace for the admission of the pulverizer, and for the regulation of the draught, a stronger draught being required in burning astatki than in burning coal. A diagram is here shown of the furnace of a Baku marine engine (Fig. 3). A small tank containing petroleum has to be placed in such a position that the astatki shall be readily supplied to the burner. This tank is filled from the main petroleum tanks. All the alterations for the conversion of a coal-burning furnace into an astatki-burning one can be made in a few very days, and the re-conversion of an astatki-burning furnace into one burning coal is very much simpler. It is only necessary to take the brickwork out of the furnace, replace the firebars, and put in a new door; in fact the alterations for this re-conversion could be carried out in one day if necessary. A great many of the furnaces of the steamers on the Caspian Sea and on the Volga were originally constructed to burn coal, and have been converted to their present use, but where a furnace is specially constructed to burn astatki, it has been found that better results are obtained if the boiler tubes are made longer and of less diameter than in a boiler intended for use with coal, and the same remark holds good for locomotives in which astatki is used.

In furnaces of land boilers, the space being larger, it is usual to reduce it by building a fire-brick tunnel with many openings in the interior of the furnace. At Novo Rassisk I was present when a land boiler used at some Portland cement works, in grinding the cement, was converted from a coal-burning furnace to an astatki-burning one. The boilers were ordinary cylindrical boilers below, with tubular boilers above, and had been constructed by Borsig, of Berlin. Great difficulty had been found when coal was used, unless it was of the very best quality, in obtaining power enough to drive the grinding mill, but with astatki no such difficulty occurred. I here show a diagram of a section of the brick tunnel in this furnace, and also a side view of it (*vide* Fig. 5). I know of one marine engine which has this brick tunnel in its furnace.

Besides the steamers on the Caspian a few on the Black Sea now burn petroleum. Mr. Tweedie, an English merchant of Odessa, has had some of his vessels running on the Black Sea converted so as to burn astatki, and I believe proposes to convert the whole of his fleet in a short time. In England two or three vessels are building intended to burn petroleum; one at Messrs. Armstrong's works, on the Tyne, and one or two more elsewhere. These will not only burn petroleum,

but are tank steamers especially constructed for the carriage of petroleum and its various products. On the Caspian Sea there are a number of tank steamers, many of them belonging to Messrs. Nobel, but also some to other Companies, which are constructed for carrying petroleum, but they are not intended for long sea voyages. A tank steamer called the "Svet," has been built at Mothala, in Sweden, specially for the carriage of petroleum products on long sea voyages. Two more are being built at the same place for the Russian Black Sea Company. In the Caspian tank steamers the skin of the ship itself forms the outside of the tanks, but in the "Svet" the tanks are quite separate from the sides of the vessel. I have heard within the last few days that there is some probability of the "Svet," which is now at Gibraltar, bringing a cargo to London, and an opportunity may thus occur of examining her. A vessel constructed to burn petroleum refuse was, I know, launched in England in March or April last.

Another great advantage that *astatki* has over coal is the facility of taking in a cargo. All of us must remember the disagreeables of coaling and the utter discomfort caused by it. Everything in the vessel is covered with a grimy coat of coal-dust, but with the cleanly *astatki* none of these horrors have to be endured. A connection is made through a pipe from the shore to the steamer requiring a cargo of *astatki*, and it is pumped into the tanks on board at the rate of 100 tons an hour by a steam pump. At Baku 800 tons of petroleum are placed on board a steamer in eight hours. If a vessel required a very large cargo of *astatki*, by using several pipes she might fill several tanks at the same time, thus reducing the time necessary for taking on board her cargo of fuel.

I have heard two objections made in England to the use of petroleum as fuel: first, that it is highly inflammable and dangerous in use. I have shown that this objection is groundless in the case of *astatki*, which is by no means so, though crude petroleum is highly inflammable, but no one would propose to burn crude petroleum in marine furnaces. The flashing point of *astatki* is from 316° to 322° , and the burning point is about 416° to 422° . A good deal of confusion is caused by people not understanding the difference between the flashing point and burning point of mineral oils. The flashing point is when such a temperature is reached that the oil gives off gas but does not itself burn. I produce before you a machine that is used for testing kerosene oil, and I will show the difference between the flashing point and the burning point, and you will see that even when the kerosene attains the flashing point and a light is applied, it will not burn, a far higher temperature is required for that. I should have liked to have carried out this experiment in your presence with *astatki*, of which I here produce a sample, but the flashing point and especially the burning point of *astatki* is so high that I should have considerable difficulty in a place like this in obtaining the necessary heat to raise it to its burning point. I, therefore, show the experiment with kerosene which has a low flashing and burning point.

The other objection made to its use is that it could not be procured in sufficient quantities at a reasonable price. I have endeavoured to show that millions of tons of it could be procured even now at a price by no means placing its use beyond the reach of competition with coal in the Mediterranean and eastern seas. When the pipe line from Baku to Batoum is laid down the price will be so much lowered that it will easily compete with coal in all countries where coal is not a home product, and the advantages attending its use which I will here recapitulate are so great that except in the question of price coal could not enter into competition with it at all. Firstly.—Astatki requires rather less room than coal for its stowage. Secondly.—It can be stowed on board vessels in spaces that could not possibly be availed of for coal, for instance, between the inner and outer bottom of a ship. Thirdly.—It is cleanly in use, there being no cinders or ashes. Fourthly.—It almost does away with the necessity of a fire crew beyond the number necessary for cleaning the machinery and superintending the steam. Anyone who has watched stokers at work in the hold of a coal-burning ship in the hot weather in the Red Sea would appreciate the advantages of doing away with all stoking. Fifthly.—The great facility of loading is an enormous advantage, and the absence of smoke is by no means its least good quality.

It may be objected that we could not trust to Russia for a supply of petroleum for our ships in case of war, but for the present petroleum refuse could be procured from Russia, and it is a product which is found in so many countries that if there was a demand the supply could be obtained from many other lands. Besides the supply procurable from America, Upper Burmah, which happily is ours, can give us large quantities. It has been found in India, and some is actually being used experimentally on the railway in that country, while its discovery on the western coast of the Red Sea, it is believed in considerable quantities, is a point of great importance. Petroleum can also be obtained from Australia. I think that petroleum will eventually be discovered in the Persian Gulf and on the Beloochistan coast, as mud volcanoes are numerous in that part of the world. In the Caucasus mud volcanoes are looked upon as almost a sure indication of petroleum. I do not here refer to the hydrocarbons produced in England, as I fear the price might be too high if a large demand arose.

I wish most earnestly to bring to the notice of our naval authorities the advantages a Russian war vessel burning petroleum would have over our vessels burning coal. In case of war a fast Russian war vessel having on board, say, 1,500 tons of petroleum, could keep at sea for a very long period, and do our shipping interests incalculable mischief. She would probably be captured when her supply of petroleum fuel was exhausted, but it would be well worth Russia's while to lose a ship after all the mischief she could accomplish during the time her supply of fuel was available. Vessels burning coal would have a very bad chance of capturing her as long as her fuel lasted, as they would require to replenish their supply long before she would require to do so, and it is not even quite certain that she

would be helpless when her supply of astatki came to an end, for it would be quite possible if she could procure a supply of coal to alter her furnaces in a day or two so as to burn that fuel.

The very great advantage that would be obtained by torpedo-boats burning astatki over torpedo-boats burning coal I need hardly point out. In these small vessels a hydrocarbon like astatki, whose steam-generating power is nearly double that of coal, would give the boats using it an immense superiority, to say nothing of the advantage gained by their power of approaching the enemy at night unseen in consequence of the almost entire absence of smoke.

It should be our object to have a supply of astatki stored for the use of our vessels at different points in the Red and Mediterranean Seas and Indian Ocean. If we had large reservoirs containing astatki in Cyprus, at Malta, Gibraltar, Aden, Ceylon, Singapore, and Hong Kong, our vessels, both of the mercantile marine and Royal Navy, which need that fuel would have an immense advantage over the ships of any nation burning coal.

MR. EDWIN HENWOOD: Mr. Chairman, ladies and gentlemen, I have much pleasure in stating that as far as the burning of petroleum has been carried out under my patent system it is a most perfect success. I fitted it to a steamer last year on the Thames and have had her running now for some months. It has been seen by several people and very highly approved of. There is not a particle of smoke, and when the petroleum is properly burned there is nothing to be seen in the brightest sunshine except a transparent gas through which you cannot even look at the sun. The advantages of storing are enormous, and the amount of evaporation obtained under my system is such as to surpass coal by over four times, so that in the case of torpedo-boats and for vessels going long distances there can be no question whatever as to the enormous advantage that a vessel so fitted will have over others. In addition to that the boilers can be constructed of smaller dimensions, and in many ways rendered more efficient by having smaller diameters, less thickness of plating, and higher pressures. The steamer that I have had on the Thames is one of 120 tons with old-fashioned engines, and the rate of consumption we find to be under most careful testing only $\frac{3}{4}$ lb. of fuel per horse-power per hour. With a compound engine or a triple or quadruple expansion engine the consumption I believe will not be found to exceed $\frac{1}{3}$ lb. of fuel per horse-power per hour.

MR. BOVERTON REDWOOD: The subject of the use of astatki as liquid fuel has been so well treated this afternoon by Colonel Stewart that I feel that one cannot with advantage add very much to what he has said as to the details of various methods employed in using that fuel in Russia, but as I am practically acquainted with the petroleum industry of Russia as well as with that of the United States, I may perhaps be allowed to speak on one or two of the points which Colonel Stewart has alluded to. In the first place, as to the very important point of the productiveness of the Russian petroleum fields and the amount of petroleum which the world is likely to be able to obtain from Russia, I think there can be no doubt whatever that the matter may be regarded as very much on the same footing as the question of coal supply; that is to say, although it may become an important question for succeeding generations, it is not one which we need address ourselves to with any great seriousness. I was practically acquainted with some of the most productive wells of the United States before I paid a visit to the oil-fields in Southern Russia, but I was wholly unprepared for the evidence I there saw of the enormous productiveness of the Balakhani-Saboontchi field. I had an opportunity of seeing one of the spouting wells referred to by Colonel Stewart opened, and I certainly was very much impressed with what I saw. Immediately upon the slide being drawn there was a gigantic column of oil about one foot in diameter thrown up to a height of over 100 feet, and to a still greater elevation one could see large stones being pro-

jected, exhibiting the force with which the oil was being discharged. In point of fact a pressure gauge applied to some of these wells has indicated something like 200 lbs. to the square inch. Colonel Stewart has said that he is not aware that there are any wells in the United States more productive than some of these flowing wells in the Baku district. He might certainly have put the case more strongly, because there is no doubt that the most productive well in the United States has yielded in 24 hours only $\frac{1}{4}$ th or $\frac{1}{8}$ th of the quantity estimated to have been discharged by some of these flowing wells in the Baku district. As regards the use of astatki as fuel, I should like to say just a word in praise of the results which have been obtained by Mr. Ludwig Nobel in the use of the "trough" burner, one of the forms of which arrangement is on the table before you. I found the arrangement in question being used for metallurgical purposes in St. Petersburg, and although that is perhaps a little foreign to the subject we are now considering, yet as indicating the amount of heat which can readily be obtained by the use of liquid fuel, I may mention that I saw pure, soft iron brought into a state of limpid, liquid fusion, in fact so limpid that small spanners and other articles were cast without the least difficulty. I hardly believed that the iron could be pure, because as we all know while the melting point of cast iron is comparatively low that of pure iron is very high indeed, and in order to show me that the iron was as soft as was contended, an engineer took one of these castings and, after it had been allowed to cool, bent it into the form of a flattened letter S under the steam hammer. The metal did not show the smallest sign of fracture, indicating how malleable it was. As regards the question of the supply of this liquid fuel at Batoum, Colonel Stewart has pointed out that by the construction of a pipe line the astatki can be supplied on the shores of the Black Sea. But although it will no doubt be necessary to have some better method of transport than is afforded by the present Trans-Caucasian railway, which passes over a gradient of 1 in 22 in one place, yet I think we can hardly hope in the first instance to get all the results from a pipe line which Colonel Stewart has, as I am afraid rather sanguinely, anticipated. I am not aware that it is proposed at present to lay more than one line, and that being so it will only be available for the transport of one class of material. The proposition, as I have had it put before me, is to use the line for the transport of burning oil, which after all is the material which has up to the present time attracted the greatest amount of attention, being that which finds the readier market, and the only method in which one pipe could answer for the transport of the various products would be by transferring the refining arrangements from Baku to Batoum, and transporting the crude oil to Batoum where it would be refined and separated into the various commercial products including astatki. I will only just say one word in conclusion in reference to the various routes to Baku. I am under the impression that in consequence of the very interesting nature of the tribes inhabiting the Caucasus, and the very beautiful character of the scenery, the Caucasus is likely to become a fashionable resort. I believe people do not quite clearly understand how very easily a trip, a trip of the most interesting character, may be made to Baku, going first to Nijni Novgorod, and, instead of taking a train, as Colonel Stewart suggests, to Zaritzin, going down the Volga the whole way from Nijni to Astrakhan, by one of the excellent saloon steamers. One sees a great deal of Russian provincial life which is of great interest, and the journey, although a longer one, affords a good rest to a hard-worked man. Travelling from Astrakhan to Baku, down the Caspian, one has an opportunity of seeing astatki used as fuel on the steamer and watching the manner in which the single attendant, instead of being busily engaged in stoking the furnace, is sitting at his ease and merely regulating from time to time the taps in the pipes which supply the astatki and steam. From Baku one then takes the train to Batoum, but at Tiflis, *en route*, a visit should be paid to Vladikavkaz, which lies amid scenery reminding one of the Alps, though it is grander and more like the scenery which one gets in the neighbourhood of Darjeeling, in India. From Batoum I can recommend taking a steamer along the Asia Minor coast to Constantinople, instead of going to Odessa. One thus has an opportunity of landing at Trebizond and other places well worth seeing. The whole round constitutes a trip which may be easily made in less than three months, and which is very full of interest.

Admiral Sir ERASMUS OMMANNEY: In constructing engines to burn this fuel I should like to know whether any space is gained owing to their being smaller than the ordinary engines.

Admiral SELWYN: I am naturally very much pleased to hear gentlemen coming from a totally different view of the subject to that which I have taken for the last twenty years, so strongly pointing out the advantages to be gained by the substitution of oil for coal, whether it is called *astatki* or the kind of refuse product which comes very near to *astatki* in this country, except that it has considerably greater specific gravity, and which we have always used. I have never used oil lighter than the gravity of water, even salt water, but always higher from two causes which I will develop later. I am very much pleased to find at last, after attention has been drawn to the subject for so long a time, that while in this country the first progress was made and has been to the present date continued, other nations are successfully using it with much less maritime interest than we have, and that they have left us far behind, not in the race of knowledge, but in the race of application. I quite agree with all that Colonel Stewart has so ably said as to the absolute necessity of not letting this be the case any longer. I do not propose to enter into what has been done here, though that is of the greatest interest to me, because Colonel Stewart, in his paper, has practically banished that from the discussion, and I wish to speak mainly to points which he has raised, and those points on which I think I can perhaps either afford some information or correct some statements which are slightly mistaken. And first with regard to the advantages gained. Now these, of course, are the fundamental facts on which we must go in estimating how far oil can compete with coal, and if they have been mis-stated in any sort of way we should then arrive at false conclusions. In practice in England for many years past we have very largely surpassed anything that Mr. Urquhart or anybody else in Russia has ever done, we having produced an evaporation generally nearly twice as great as they produced there, and sometimes even more than that—I cannot say absolutely at present more than twice as much, but six times as much as can be done with coal. If we take Mr. Urquhart's statements, the figures will all come out far below the actual facts. First of all, I think he has given rather too high an evaporative value to coal. We know in modern days we have had very great claims as to the evaporative power of coal. These have arisen from the fact that we have got more horse-power out of a similar amount of coal, and we have still to lament the fact that when we take the same engine, the boiler being at the same pressure, we still get not more than 7 or $7\frac{1}{2}$ lbs. But is it possible to get very much more than this out of coal? I answer that you never can do very much more than our practice has shown us during the past two centuries, for the reason that the total theoretic value of coal being about 15·75 lbs. of water vaporizable, as shown by the late Professor Rankine, six units are lost in transforming the solid coal into the gaseous state, and two units are lost at 600° F. up the funnel, $15\cdot75 - 8 = 7\cdot75$ theoretically available. You can get an enormous deal more value out of coal by putting a higher pressure on the boiler, but you cannot get a greater evaporative value. Those who propose to do it to-day do it by means of the higher pressure, which gives more mechanical duty arising from a pound of coal, but they do not do it by higher evaporation, that remains the same as it was before. If we take then the real facts with reference to *astatki* or oil of any description such as would be recommended for use on board ship, that is to say, with the specific gravity passing that of salt water or approaching it, in the case of *astatki*, as nearly as possible—the specific gravity of *astatki* being about 910, and that of the oil we burn here from 1,050 to 1,070, we get three times the duty of coal at once and easily, and that without any very special appliances. This affects the whole problem in this way: instead of carrying one-and-a-half times as much fuel on board ship you carry three times as much, so that I am starting now as low as it is necessary to do and far below what I know can be done. The next statement which I wish to notice is that with regard to Mr. Lentz's statement that it is cheaper to use steam as a pulverizer, but that better results are obtained by a jet of air. Now any engineer will understand me perfectly well when I say that if you use air you must produce it by the use of power, that this use of power involves an expenditure of fuel or steam, and therefore until you have deducted whatever you require to make the jet of air available you have not got at the true result of

your evaporation. One of the laws which obtain I think almost universally among engineers is that the more changes power passes through from the raw material to the form in which you use it the less mechanical value you can get out of it. If we use steam to blow in air we find that a jet of steam with a pressure of over 30 lbs. to an inch induces a quantity of air 216 times its own bulk; therefore, the steam used alone does infinitely more than we could possibly expect to do by putting that steam into an engine, using the engine to drive a blower, and thus driving in air. I am now leaving entirely on one side the useful combination of the hydrogen and the steam. 3,500 revolutions a minute cannot be obtained without considerable power, and when you have got it, instead of having steam at the temperature of superheated steam, you have cold air, the nitrogen and oxygen of which have to be raised to the temperature of the furnaces before they can be burned. Therefore, there are two losses which justify all our early practice in 1867. At Woolwich, Mr. Crampton was using air in that year to blow in oil, and he failed on this account, and its use was entirely superseded thereafter in England by the use of steam. The next case is where the oil used is gasolene. You must recollect when you come to gasolene or any of the lighter products of the petroleum oil you obtain a material which, containing as it does more hydrogen, has a larger calorific value, and that if you were to compare it with astatki, whose calorific value never rises higher than 20—I am speaking of the theoretical calorific value—you will find that with gasolene you will rise to 22 and to 24 and in rare cases to 27; therefore, you cannot compare at all the evaporative value with that previously obtained with any useful result. I note also a very curious thing in these days of engineering, that at Baku ordinary pumps are not used because the metallic valves would wear out with the sand. I think the man who does not use leather in a sand-pump does not know that this particular oil is one of the best preservatives of leather ever known; leather will last a wonderful time in it, and leather will not be attacked by sand. It has been used in sand-pumps ever since I was a boy. I should be very sorry indeed to resort to drawing oil out of a well by a tube in the way described. As to the delivery of astatki at Egypt, Malta, Cyprus, and the Red Sea, I have very little doubt that as soon as there is a demand for it the oil can be delivered at a price even below that at which Colonel Stewart has put, and that without any reference to the difficulties of a pipe line. Whenever a commercial operation can be carried out at a profit, the question of what plant you employ becomes a very minor one, and pipe lines sufficient for all purposes can easily be laid down. I cannot join with the previous speaker who said that it would be cheaper to transfer the raw material to a point on the Black Sea at a considerable expense and then distil it. In fact, carrying the raw material at great expense instead of carrying the finished product. I should say that is opposed to all our practice in engineering, mining, and every other way. But even supposing we had no astatki available from Russia, and that we do not rely on foreign sources of supply, is there any difficulty in laying down any quantity of oil coming from England and produced in England at as low a price at any point you like to take it to—Malta, Gibraltar, or any other place in the Mediterranean? Not the slightest. We possess a greater store of oil in the solid form in this country than has ever been obtained either at Baku or in any other country in the world. From Dorsetshire on the south coast to Norfolk on the east we possess beds of shale which give 120 gallons of oil to the ton on distillation, and which are 650 feet thick, and lie within 30 feet of the surface of the ground. This is only what has been ascertained and practically shown. As to what width those beds extend we have no available geological knowledge, but from the Geological Museum I have obtained these facts, and they are patent to the whole world. We can distil that at a price which will probably leave a considerable profit on twenty shillings a ton in this country. There is no difficulty in attaining it either now or in the next ten centuries if you like, and when that time has passed I do not think any of those who are present in this Institution will probably be talking about it or will occupy themselves with any doubts on the question of oil *versus* coal. With reference to the astatki over coal for stowage, Colonel Stewart does not quite give the data. If you take the specific gravity of water to be 1,000, you then calculate 35 cubic feet of space to every ton of water. Coal will occupy 45 cubic feet, whereas astatki being of a specific gravity of 910 would occupy little more space than the water, and the

oil, whose specific gravity rises above that of salt water, will occupy less, *i.e.*, 32 feet while coal occupies 45. Colonel Stewart has also pointed out very properly that this oil can be stowed as no coal could be stowed in places not now utilized, and with much better distribution of weights than we are now obliged to have. Sir Edward Reed drew my attention to the fact that in our modern men-of-war we have very great difficulty in providing for the transmission of coal to the fire, whereas with this oil all these difficulties disappear. Lord George Hamilton lamented the necessity for an army of stokers in the Navy. I must say it seems to me very extraordinary that up to this time, though I have over and over again affirmed it, and Colonel Stewart gives the strongest testimony to the same thing, no change has been made in this direction. I say that no stokers whatever are necessary, not a single stoker is needed on board a ship at all; you do not want coal trimmers, you do not want stokers, you do want men to attend to the machinery, and these men will do all that is necessary, and very little it is, in attending to the fire. In the case of the various systems which Colonel Stewart has shown us adopted for burning this liquid fuel in Russia, I am afraid I cannot recognize any great amount of knowledge, and certainly no advance or improvement over the systems adopted in this country in 1868-69. Then we had the same injector which is now used; then we had the evaporation of 17 lbs. of water per pound of fuel used at Woolwich, the Blue-books show that, therefore I need only refer to them without making any statement about it myself. I quite agree with Colonel Stewart in saying the advantages compared with coal are so great that there is no possibility, where it is once known or used, of coal ever entering into competition with it at all. May I draw attention to one fact connected with that subject? Our modern steamers of high speed, such as the "Aurania," burn 430 tons of coal per day. The result is that almost their whole cargo-space is taken up by that consumable store, and those vessels cannot possibly pay dividends on consumable stores. The result also is unfortunately that only eleven lines of steamers sailing out of the British Islands are able to pay dividends to-day, and those who do pay them are mainly doing it from subsidies of some kind or other. This is a most serious fact which points, if it were allowed to continue, to the extinction of our mercantile marine. Too much attention cannot be drawn to the subject in that way. Colonel Stewart says that "in the Caucasus mud-volcanoes are looked upon as almost a sure indication of petroleum." Before going to Egypt, Mr. Tweddle told me he knew that Penjdeh was a point at which these mud-volcanoes were found in the largest numbers, and to which we might well look for the largest supply of oil. I think that explains why Penjdeh has been so rapidly annexed. With regard to the few words that Colonel Stewart has said about the Navy, I have long pointed out the same thing. I say distinctly no man-of-war ought to go to sea to-day with the knowledge that there may be another vessel at sea of her own force which can carry, according to Colonel Stewart's idea, $1\frac{1}{2}$ times her amount of fuel, and, according to my idea, about 6 times. He says also that she can resort to coal in the event of her oil supply failing. All I can say is that I can meet a steamer at sea in a given latitude and longitude, and if that steamer is loaded with oil, without any boat-transfer and by means of a simple pipe, I can replenish my own stores of fuel as I tow her ahead. That does away with all the difficulties about coaling at sea and neutral ports. As to the great effect of the liquid fuel on iron and other metallic substances, I am not sure whether I have told the Institution before, but Messrs. Johnson and Matthey have been ever since 1871 using this oil persistently in their furnaces in Hatton Garden for melting platinum. The melting-point of platinum is $3,080^{\circ}$, and Mr. Matthey told me since that, whereas previously platinum was one of the most refractory metals he ever had to deal with, he now finds no more difficulty in melting platinum than he did formerly in melting lead. If that be true, of course the case is very much more so with regard to iron. Mr. Nordenfelt has brought out a metal which is wrought iron entirely melted and cast by the use of these petroleum fires, so I think we have on all hands a consensus of opinion in favour of turning to this as a new fuel with much greater power, much more available, and absolutely essential to our mercantile marine and Navy.

Mr. CHARLES MARVIN: Colonel Stewart has described so fully in his admirable lecture the oil industry at Baku, and especially those features connected with liquid

fuel, that it is very difficult for me to add anything of serious importance to his remarks. There are, however, one or two observations which I may make, which may possess a certain amount of value, as confirming what he has said, and may shed a little further light on the subject. Mr. Redwood, who undertook a journey to Baku a short time ago, has described in the most graphic manner how easy it is now-a-days to go to Baku. As a matter of fact, it is so very simple that within the last few weeks two of our tourist agencies in London have made arrangements for taking tourists to Baku. About a fortnight ago Messrs. Gaze left with one party, and I believe in a week or two Messrs. Cook will be leaving with another; so that Baku, which, in 1866, when Colonel Stewart paid his first visit, was really very difficult to get at, has now become almost a pleasure resort to English tourists. The next point I would refer to is the question of the safety of liquid fuel. On that point I think there can be really no room for discussion. On the Caspian and Volga there are over 200 steamers burning liquid fuel. Some have been using it for the last fifteen years; one steamer in particular has made no less than 250 voyages, using liquid fuel, so that taking the whole of those steamers together, probably some thousands of voyages have been made with liquid fuel without, so far as I am aware, a single accident; or, at any rate, without a single serious accident. With regard to the observation dropped by Admiral Selwyn with respect to the probability of there being petroleum at Penjdeh, it may be interesting to state that within the last few weeks I have received a letter from the Caucasus stating that very considerable discoveries of petroleum have been made near Askabad and Merv. There are also indications of considerable petroleum deposit between Askabad and Herat, and I should not be at all astonished if the prediction made as to there being oil at Penjdeh should turn out to be true. We know that as the Russians have advanced from the Caspian in the direction of Herat they have discovered petroleum at half a dozen different points, while we on our part in advancing from India into Beloochistan have discovered petroleum as far as Quetta. There is, therefore, very great probability that the petroleum chain starting from the Crimea, and running across the mountains to the Caspian, and from the Caspian in the direction of Herat as far as Dushak and Penjdeh, also extends beyond again as far as Quetta. These discoveries of petroleum in Central Asia give very great importance to the Russian annexations in that region, but side by side with this the recent discovery of petroleum in Egypt also adds to the importance of our hold upon that country. Colonel Stewart has called attention to the very great value which liquid fuel would be to our fleet in time of war, and I think everybody who is at all connected with the Army and Navy will recognize the advantage of having a large supply of liquid fuel close to the Suez Canal. The crude petroleum which has been discovered in Egypt, and which so far as is yet known does not contain much oil for illuminating purposes, still is very well adapted for liquid fuel, and I have no doubt that once steamers begin to use liquid fuel in the Mediterranean and the East, these petroleum fields in Egypt will acquire very considerable importance. With regard to the observations that were made by Admiral Selwyn respecting Mr. Urquhart, an Englishman in Russia, and Mr. Lentz, who has acquired a great reputation on the Caspian by his liquid fuel inventions, it should be clearly understood that while in this country liquid fuel has scarcely got beyond the experimental stage, in the Caspian Sea it has altogether become common-place and matter of ordinary use. Mr. Lentz, for instance, has been running steamers on the Caspian Sea the last ten or fifteen years, and he has made a number of inventions, and these inventions have not only got beyond the experimental stage but they have been used for years past, giving great satisfaction to the shipowners on the Caspian.¹ Probably those inven-

¹ See the chapter on "Liquid Fuel" in "The Region of the Eternal Fire" (London: Allen and Co., 1884), pp. 258-282, where the history of the various liquid fuel furnaces in the Caspian is given and the operations of Lentz described. Probably, besides 200 steamers, more than 500 locomotives and 800 stationary engines, large and small, burn liquid fuel in Russia; so that the practice is thoroughly established there, while we have not yet got beyond the amateur stage. —C. M.

tions will be improved upon in time, and in that case Mr. Lentz will acquire a greater reputation in this country. But, at any rate, in the meanwhile it should be clearly understood that the statements of Mr. Lentz are based upon actual practice and not upon mere theory at all. There is one very important feature in connection with this liquid fuel in Russia, which I think ought not to escape the attention of English capitalists and shipowners, and that is this: that as petroleum extends itself more and more over Russia, in the Black Sea regions, and also to some extent in the Baltic, English coal will be driven out of the market of Russia. This will naturally seriously affect English enterprise and capital, and I think it would be a good thing in the interests of English trade if that enterprise and capital could be diverted in good time into the petroleum fields belonging to the British Empire. One final word with regard to the pipe line connecting Baku and Batoum. This very important question is so far advanced now that in principle the Russian Government has decided to support any reliable pipe line enterprise submitted to it. The matter is now before the Council of State at St. Petersburg, and the form of concession is being drawn up. Different people have applied for the concession, and the competition will probably not only result in the construction of a line to be employed in the conveyance of kerosene, or lamp oil, but also very possibly may provoke the laying down of another pipe line to convey liquid fuel to Batoum.

Mr. EDWARD FIELD, C.E.: I do not know that I have much to say on this subject, but being an old hand at burning petroleum it may be interesting to know that I began in 1865, and have been engaged in the matter ever since. I have steadily watched the progress of improvements in apparatus for its consumption. It seems to me that petroleum can not only be burnt to do a considerably better duty than coal, but that it can be burnt to do from three to four times the duty of coal at the same cost if properly burnt. All depends on the apparatus which is used in burning. I am not prepared now to go through all the apparatus that has been applied, but as far as I can see there is not a single improvement beyond that which Admiral Selwyn brought out in 1867-68. I gave up trying to do anything with it simply for this reason, that we could not possibly get the oil at a price that would pay; as soon as we tried to make contracts for the oil at a price that would pay better than coal, the market rose, and the result was we were flooded. The matter rested until Admiral Selwyn took it up some years afterwards and made sundry improvements in the injectors. Mr. E. H. Aydon, C.E., who died last year, was the first who, as far as my knowledge goes, ever injected petroleum into furnaces by means of steam. The injector system is the only system which has proved effective. Admiral Selwyn has improved that injector very much, and has been lately burning a considerable quantity of oil for the purpose of showing the public that it is possible not only to burn it but to burn it well, and to enable us to use the oil in our Navy. Its importance to this country is beyond anything that can be possibly expressed. Unquestionably we must come to it at last. Why are we losing all this valuable time before we do it? This thing has been known for the last eighteen or twenty years, and it has been shown how to burn it properly, and yet we cannot get the public, for some reason or other, to entertain the matter. I am sure we are all deeply indebted to Colonel Stewart for his paper, and I should like to mention that I think we are equally indebted to Admiral Selwyn for the persistent way in which he has adhered to this subject and the improvements he has introduced. The process used on the Caspian is simply a copy of Admiral Selwyn's. I do not wish to disparage Mr. Urquhart's process because it is the right one, but still he ought to give due credit, I think, to the original inventor.

Admiral the Hon. E. R. FREMANTLE, C.B.: I am glad to say a few words on this question, especially because it had been dealt with to some extent as from a national point of view by some of the last speakers. We have had a very instructive and a very useful lecture, and everything which tends to the pursuit of science, and especially to nautical science, is in this theatre very well received, and we are in our right in discussing it. From that point of view I feel quite certain that what Colonel Stewart has said is not in the least exaggerated, and those gentlemen who are so well acquainted whether with the wells in Asia or with the scientific results

of the use of petroleum, have all borne witness to the fact that the prospects of its general utility have not been the least exaggerated by Colonel Stewart. There is no doubt, I think, that the evaporative power has not been exaggerated. There is no doubt, I think, that the capacity of storage of the oil and its other advantages over coal have not been exaggerated. As to the question of coaling, I think that must approve itself to all of us, the same as regards cleanliness, and certainly we should have very much fewer stokers, and very great advantages would accrue to our passenger steamers, especially those which have to go through the tropics. All those matters I willingly admit, and all those matters are no doubt subjects of congratulation. But when we look upon it rather more from a national point of view, though I can quite understand it may be a subject of great congratulation to Admiral Selwyn, who has so often and so well brought the subject before us in this theatre, to find that coal is likely to be so very shortly dispensed with, and that we should have to draw our supplies from petroleum; it is *succès d'estime* to him, but I question very much whether it is a subject which is one of congratulation to this country. Mr. Marvin has touched upon the question of the large industry and the immense amount of capital employed in our coal mines, and we cannot look entirely with satisfaction to the depreciation of that very great industry. Therefore I hope that it will be the case that these beds of shale to which Admiral Selwyn alludes may be found to be capable of producing some sort of oil which will be useful, though I may doubt whether it will be able to come into competition with the oil which we hear is so prolific in these wells in Asia. It cannot be a satisfaction to us to assume that all our vessels will have to go to the Black Sea to get that fuel; that is a thing which requires no argument whatever. There are industries which are conducted on one side of the globe and industries on the other side of the globe, and occasionally you find what is better for one set of people and which may be well worked with advantage on the Eastern Hemisphere cannot be worked with advantage on the Western. So it may be for a certain time to come with regard to coal, that is to say, that it may still be an advantage for a very long period of time for our vessels to draw their supplies of coal from England, whilst vessels trading in the East and I quite admit in the Red Sea, and not only in the Black Sea but perhaps also in the Mediterranean, may draw their supplies of petroleum from the Russian wells. But whilst on that question I regret to find that there is so very little of the British Empire where these wells of petroleum are to be found; perhaps I ought not to say "very little." It is mentioned in the table that petroleum is found in Upper Burmah, and Canada and New Zealand are also mentioned. I should like to know whether the lecturer or any one is aware to what extent it could be supplied in New Zealand. I have alluded to the question of the coal supply in England, and we know also that in Australia there is an exceedingly good and satisfactory coal found in very large quantities at Newcastle in New South Wales; therefore, as far as the British Empire is concerned, and as far as our interests are concerned, it would appear that our interests are still on the side of coal, and therefore I cannot share in the feelings of one of the speakers, who seemed to be very much astonished that we were not as a nation disposed to take up petroleum very rapidly. The question will eventually be decided as to what is the cheapest material to burn, and if the cheapest material to burn is petroleum I cannot doubt but that in the process of time all the mercantile communities whether of this or other countries will generally use liquid fuel in their steamers; it has been pointed out with great force about the enormous coal expenditure of our American lines, which I believe to be perfectly correct. That being so we shall in process of time undoubtedly have great stores of this petroleum in different places, and when that is the case men-of-war will certainly follow suit. But until that is the case, while the mercantile community have stores of coal in different parts of the world, although the Government might be inclined to make stores of petroleum, I question whether they would be able to have a sufficient number of these petroleum stations to supply their needs, and whether they would not have occasionally to come down upon the mercantile community for supplies, and unless those supplies can be given we cannot expect the Government to take the lead very much in allowing their ships to burn petroleum. I wish to conclude by asking one question, as to whether Colonel Stewart can tell us whether with this *astatki*, which appears to be a product of considerable specific

gravity, and which appears to be rather thick as far as we can see it, there is any deposit at the bottom of the bunkers in which it is used which requires to be cleaned out occasionally, or whether it is perfectly fluid so that there is no difficulty of that sort arising?

Admiral SELWYN: May I say I think Admiral Fremantle has a little mistaken what has been said before? I have told him that this is a material which exists in this country in larger quantities than in any other, but it is in the solid state. The oil is extracted from it by the application of heat obtained from the substance itself, and we can dig more of this than we can of coal, and much more easily. Secondly, that there is this oily substance in some form all over the world; Australia, New Zealand, British Columbia, every part of the globe in which we could wish to find liquid fuel for any purpose whatever contains it; thirdly, that it can be laid down as easily as coal, and instead of losing half its calorific value in six months, as coal invariably does, this will conserve its value for a century or longer if stored in the most inexpensive and simple way.

Mr. MARTELL (Lloyd's): So long as this question was confined to the remarks of Colonel Stewart I did not think it necessary to rise to make any remarks, but I think, from what has been said by Admiral Selwyn and some others, a wrong impression may prevail on this question. Colonel Stewart in his remarks confined himself to the use of this liquid fuel within a certain compass—the Mediterranean and the Eastern ports. The remarks of other speakers show that this can be utilized and made use of for all parts of the world, and the impression may go abroad that such is the case. Up to the present time I think that would be quite a mistake altogether, and I will tell you why. There is no doubt, as Colonel Stewart has said, the question of practical difficulty in the use of this liquid fuel has been overcome. It can be used, there is no question about it, and it now resolves itself into a question of cost as compared with coal. What is this question of cost? At the present time crude petroleum is selling at Philadelphia at something like 3*l.* 14*s.* a ton. At a very low freight it costs 15*s.* a ton to bring that across the Atlantic, and that makes it something like 4*l.* 5*s.* a ton. How is it possible that that can compete with coal? Take the Russian product: crude petroleum is something like 2*s.* 6*d.* a ton. By the time it arrives at Batoum it would cost something like 25*s.* The distance you bring that is about 3,000 miles, the same as across the Atlantic, and the freight would be about the same. By the time you get it in England the cost would be about 40*s.* Well now, how can that compete with the cost of coal in this country? There is no fear of this at the present time superseding coal here, because when we get the very best coal at something like 8*s.* or 10*s.* per ton, and I know at the present time steamers that are going along the north-east coast, colliers, that have special boilers made expressly that are burning the dust coal, and they are getting that on board for 2*s.* 6*d.* a ton, how is it possible that oil at the present time can compete with coal? A very different state of things will have to take place. I look forward to something being done in the way of very much cheapening this petroleum, because when we have an unlimited supply such as has been shown by Colonel Stewart, it is a very desirable thing indeed to utilize that to the utmost extent. And to show what impression the question of petroleum has made upon the shipowning public of this country, I may tell you at the present time there are something like half a dozen ships being converted for the purpose of carrying from 2,000 to 3,000 tons of this oil in bulk instead of carrying it in casks, and thereby reducing the cost. I also understand that there is in contemplation the formation of a Company in London who purpose building a large number of ships that will carry something like 3,700 tons to cross the ocean with refined oil. If this can be done successfully and profitably, I hope it will extend to crude petroleum for the purpose of liquid fuel, because unless we can bring it to this country I do not think it will be sufficient to take it to Malta to utilize it for the war-ships of this country. These war-ships have to sail from this country and, therefore, the petroleum must first be brought here, and additional expense incurred unless this liquid, petroleum, can be reduced in cost in bringing it to this country. I am afraid, notwithstanding the very enthusiastic manner in which Admiral Selwyn and others have brought this question forward, it is hardly within measurable distance at present. As regards the use of shale oil, I know myself that

the managing owner of a large steamship company was desirous of using it, and made inquiries respecting it, but he found that there was not sufficient of this refuse oil produced in this country to supply his fleet alone. Unless, therefore, you can produce the crude oil for this purpose, which we can easily understand could not be done now, where the advantages of refining it would far more than compensate for selling merely the refuse of it, unless you can get a large supply of crude oil in that way, there is no fear in this country of oil superseding coal as has been asserted by Admiral Fremantle. This oil has been used in this country in a vessel called the "Himalaya," that went from London to Edinburgh, and it was used with success from an engineering point of view. There was one disadvantage found attending the steam spray, namely, that it took a very large quantity of steam from the boiler and consequently a very large quantity of fresh water which had to be replaced by salt water, and the boiler was salted up in consequence. That of course would be a very great objection on a long voyage; even if the oil were used economically for short voyages, that would be a very great objection in long voyages, unless the engineering skill and intelligence of this country could overcome it, which no doubt would be the case if it could be brought here at a moderate price so as to compete with coal.

Mr. HENWOOD: With reference to the remark that Mr. Martell has made that it would be impossible to steam war-ships out to the East and then get them supplied with oil, I would like to say this, that it would be quite easy to steam them out with coal, and then get them supplied with oil. The furnaces could be altered in 24 hours so as to burn oil. Then as to the question of using the steam for the spray it is quite within contemplation, and in some large steamers certain boilers are provided for maintaining a supply of fresh water.

Mr. MARTELL: A ship of that kind must be fitted with coal bunkers.

Admiral Sir ERASMUS OMMANNEY: It appears to me that the main point of this paper is to tell naval Officers the very great advantages that would accrue to any navy that use this fuel instead of coal, and I am sure every naval Officer will be very much obliged to Colonel Stewart for the information. If the advantages are so very great, surely we should not stand at trifles with regard to the cost, if the advantages are so very redundant. I only hope that this paper may be read by every naval Officer, and I hope that every person who is connected with the administration of the Navy will consider it. I think it would be very desirable that the Admiralty should fit some of our vessels on the home station with the same appliances for the use of petroleum fuel as those adopted by the Russian Navy in the Caspian; for instance, we employ vessels around our coasts for conveying stores between our dockyards and military stations, if such vessels could be navigated by this fuel we should soon ascertain the practical and economical advantages to be derived from this fuel, and the experiment would be most instructive in a national point of view for all parties concerned in our maritime interests.

Colonel BAYLIS: At this late hour I am reluctant to rise, but I think we may say the advantages of liquid fuel are so great over coal that if it can be applied, it ought to be applied. Of course it is a question of cost; if you can produce a better and more useful article it becomes, then, a question of price. As Colonel Stewart has alluded to the price it would come to this, whether we can obtain this liquid fuel for vessels for use on the Suez Canal or in the Mediterranean at such a price as would induce persons to go to the market and enable them to say that they will have it in preference to coal. I should like to make a remark with regard to the shale. We know that liquid fuel can be obtained from shale and I believe also from coal, but the earliest patent for obtaining oils and liquid fuel from shale and coal was taken out as long ago as 1850. That is a long time ago, and no doubt the patents have run out, and therefore I suppose we may consider that it has not been a success, for want of cheapness as compared with coal.

Admiral SELWYN: It is done at the present day, and large fortunes have been made in Scotland.

Colonel BAYLIS: The earliest patent was in 1850. I can quite enter into the feeling which Admiral Fremantle has alluded to that we should like to be able to supply ourselves, and no doubt that will commend itself very strongly to us if we can get liquid fuel at home and use it for our ships at a price that will pay in com-

parison with coal. Allow me to deviate for one moment. It is very curious indeed to find rock oil mentioned in very early history. You find it in the Book of Job, and it is mentioned in this way: in the 29th chapter and the 6th verse, Job, in speaking of the great blessings of which he had been deprived, and of his former prosperity, says this: "When I washed my steps with butter, and the rock poured me out rivers of oil." I think that is the earliest mention of rock oil.

Colonel STEWART, in reply, said: I wish to thank Admiral Selwyn very much for the kindly things he said about my lecture, but there are one or two little points I wish to explain. He objected to my statement about the values of *astatki* relatively to coal. I stated that those values were simply taken from Mr. Urquhart's work. Mr. Urquhart is said to be about the first petroleum engineer in Russia, and I gave you his statement. As to the difficulty about the pump, pumps have been tried at Baku, and leather was of course used in the valves, but the sand wore out the metal portion of the pumps, and they had to give them up.

The CHAIRMAN (Sir P. Lumsden): I think, gentlemen, at this late hour of the evening I need not say much. We owe a debt of gratitude to Colonel Stewart for the very able manner in which he has brought this subject before us. I may here corroborate the statement made by Admiral Selwyn with regard to the relative values of oil and coal in steamers, because when coming over the Caspian last year in the "*Alexander IIIrd*," the largest steamer on the Caspian, the captain assured me that after trying coal and oil for the last fifteen or twenty years he found in practice that in the same bulk, with greater facilities of package, oil would carry the steamer between three and four times longer than coal. We are extremely indebted to the different scientific gentlemen who have favoured us with their remarks. I think the discussion altogether has been a very useful one, and I hope will be taken up by the public as it certainly deserves to be. We have petroleum in all parts of our Empire—we have it in Canada, Nova Scotia, Columbia, Burmah, and in India generally, especially at the foot of the Suliman range. It is showing itself in Europe as well as in Asia. Only last year in going from Varna to Venice I met the American agent of the United American Oil Company, who had come over to that part of Europe to find out why the demand for American oil had ceased, and he found no less than nine petroleum companies, several of which were in the hands of Englishmen, excavating petroleum wells at the foot of the Carpathians. In Galicia and Roumania there seems to be an almost exhaustless supply of petroleum. It is found in Italy and in Spain within 20 miles of Cadiz, and of course should it hereafter be proved that petroleum can be worked economically it is everything for us to find stores and depôts in all seas. The springs of Columbia, New Zealand, Barbadoes, and Egypt will be of the greatest importance hereafter to this nation, because we must bear in mind that in sailing days the period a ship could remain at sea was only limited by the amount of its provisions, but now it is regulated by the number of days it can steam, or by the time that must elapse before it can get another supply of coal. Therefore, it stands to reason it will be a great advantage if we can enable our ships to stay at sea two or three times longer than they can at present and be at any time replenished with fuel. There is no doubt if a demand were created, that any amount of oil can be procured. Perhaps you are not aware that in the copper fields in Lake Superior and in the mounds of the Mississippi there are the vestiges of wells which were worked by an unknown people that existed in America before history, and we may perhaps find this to have been the case also at Penjdeh. Doubtless the whole of that valley is studded with mounds that may be of the character described by Colonel Stewart as indicating the existence of petroleum. There is no doubt petroleum presents itself along the base of the Hindu Koosh; also along our Indian border from Quetta to Peshawur it is found along the whole Suliman range, and it is just a question to what depth we have to sink to find petroleum of a workable character. In 1859 petroleum was discovered in large quantities in South California, but our Yankee cousins immediately ran down the price of petroleum in Pennsylvania to such an extent, reducing it from 17 dollars to 1½ dollars a barrel, that the hope of Californian trade had at once to be abandoned. From official reports it would appear that ten years ago the amount of petroleum produced in America was almost identical with that at present taken from the Baku wells, but to give you a slight idea how the amount in America has increased I may quote that the yield of

crude petroleum in 1864 in America amounted to 104,105,778 gallons, but last year that had increased to 913,525,998 gallons. The amount of naphtha exported in 1864 was 438,197 gallons, and in 1885 it had reached 15,822,853 gallons. The export of illuminating oil, which in 1864 was 12,791,518 gallons, had increased in 1885 to 458,243,192 gallons, and in that same year the export of residuum was 6,561,660 gallons. The total export in 1864 was 23,210,369 gallons, which had increased in 1885 to 574,668,180 gallons. "As a given number of gallons of refined petroleum represents the product of a large number of gallons of crude petroleum, it is necessary to reduce the exports of petroleum to their equivalent in crude oil in order to arrive at a knowledge of the percentage of mineral oil exported. It has been ascertained as the result of a careful computation that the quantity of petroleum and its distilled products exported during the year ending June 30, 1878, was equivalent to 407,482,175 gallons of crude oil, or in other words that the exports of petroleum constituted about 66 per cent. of the production. A larger percentage of the mineral oil product of the country is exported than of any other product except cotton." I have no doubt, if the demand were created, the increase would take place in other quarters of the world as well as in America; but this question of the application of petroleum for creation of steam is still in its infancy, and it may become one of the greatest questions of the time. I now beg in your name to return Colonel Stewart our thanks for his interesting lecture.

Wednesday, July 14, 1886.

MAJOR-GENERAL SIR FREDERICK D. MIDDLETON, K.C.M.G.,
C.B., Commanding Militia of the Dominion of Canada, in the
Chair.

REVOLVERS AND THEIR USE.

By Major H. E. C. KITCHENER, Duke of Cornwall's Light Infantry.

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 - Should the revolver be carried on service ?
 - Should Officers be armed with the rifle ?
- II. Necessity for training Officers in the use of the revolver.
 - Manner in which revolvers are often purchased.
 - Amount of instruction our Officers receive in self-defence.
- III. Proposed first course of instruction.
 - Change in ammunition.
 - Insufficiency of N.C.O.'s present course.
- IV. History of the revolver.
 - Double-action revolvers.
 - Difficulties in manner of igniting the charge. Fouling, &c., leading.
- V. Rapidity of discharge.
 - Reasons why the cylinder sometimes fails to rotate.
 - Misfires through faulty ammunition.
 - Advantage of continuous over single practice.
 - Left-handed shooting.
- VI. Accuracy.
 - Want of interest in revolver shooting.
 - Construction of revolver handle.
 - Simplicity of construction.
 - Double-barrelled pistols.
 - Penetration and stopping power.
 - Necessity for accurate aim.
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 - Recoil.
- VII. Range.
 - Long-range shooting at Sandhurst.
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 - Military revolver sighted for 50 yards.
 - Cleaning.
 - Facility for cleaning English revolvers.
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 - Reliable quality of materials important to safety.
 - Manner of carrying the revolver.
 - Chief causes of accidents.
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- IX. Danger precautions—revolver stand, barrier, safety to the public. Ammunition.
 - X. Precautions against accidents in the "field." Targets. Marker's butt. Running man.
 - XI. America : General Lee on the revolver.
American ammunition.
 - XII. Russia : Number of revolvers in possession of Russians.
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Preface.

BEFORE commencing this paper, I wish to express my acknowledgments to the many Officers and others who have so kindly assisted me with their experience and advice in compiling it.

I would also wish to point out that there is very little reliable printed matter to be found treating on the revolver, and therefore, no doubt, there will be many mistakes in this paper. I trust, however, that the discussion which I hope will follow will tend to remove them.

Introduction.

Most of us have a hobby of some sort, and for the last few years "Revolvers and their use" have been mine.

My hobby horse, like other horses of a like nature, has a trick of getting the bit between his teeth, and boring, if not his rider, at least his rider's friends.

I therefore venture, before I commence this lecture, to ask your indulgent consideration of the subject I have to lay before you ; and I trust that, though much may prove to be chaff, some grain may be found.

I.—Importance of Revolver Training.

As honorary secretary of the R.M.C. Revolver Club, I have had opportunities of observing the difficulties which beginners find in the use of the revolver, and I have been astonished at the improvement after a few weeks' training.

The importance, too, of such training has been brought forcibly before me.

Surely coolness and presence of mind at critical moments are all-important in an Officer, and any means for fostering and engendering these qualities should be encouraged. Now it is obvious that a man who feels confident in being able to protect his own life would be cooler and more self-possessed than one who has no confidence in his weapon or in his ability to use it.

An Officer's life is always valuable, especially so when conveying orders, or when reconnoitring to the front, and if he be a good revolver shot, he may pass with safety where otherwise he might fail.

For example, during the American war a Federal Lieutenant conveying orders, attended only by one orderly, was surprised by a party of the enemy's horsemen. He drew his revolver, and picking off

FIG. I.
TYPE OF SOLID FRAME. SINGLE ACTION REVOLVER.

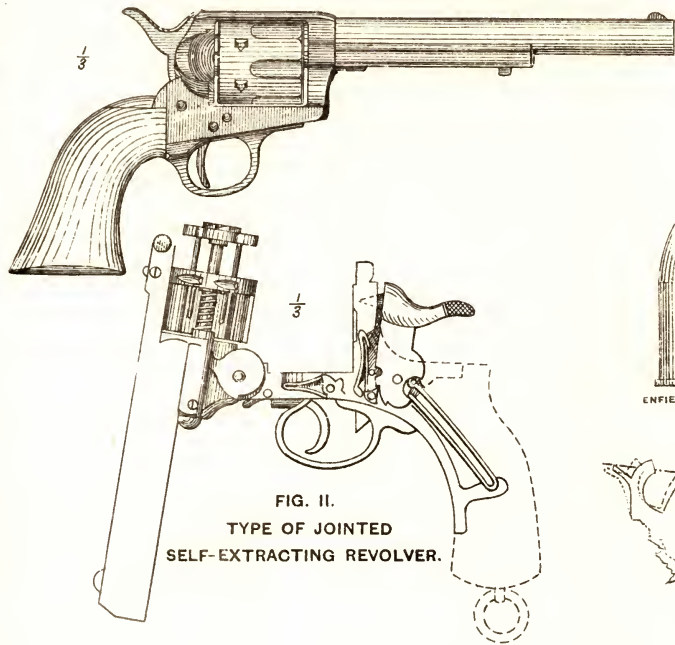


FIG. II.
TYPE OF JOINTED
SELF-EXTRACTING REVOLVER.

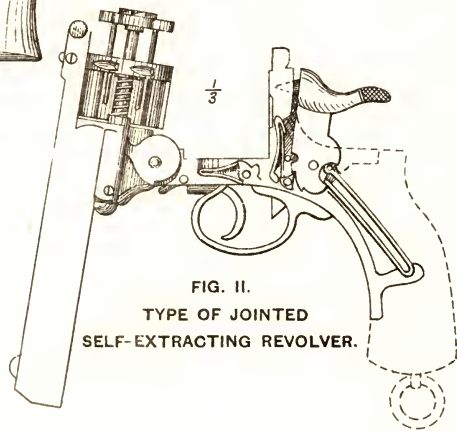


FIG. III.
TYPE OF PISTOL.

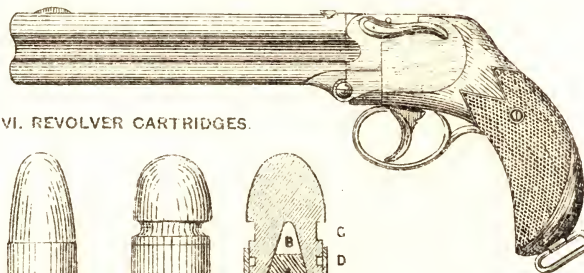


FIG. VI. REVOLVER CARTRIDGES.

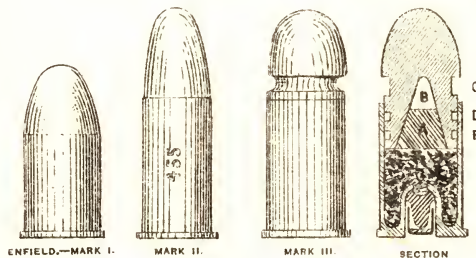


FIG. VII. EFFECT OF RECOIL.

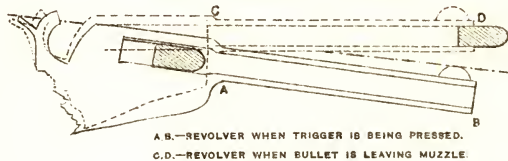


FIG. IV.
TABLE FOR REVOLVERS (R.R.)



FIG. V. REVOLVER RANGE.

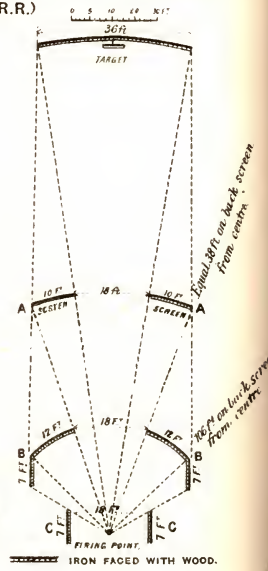


FIG. XIII.

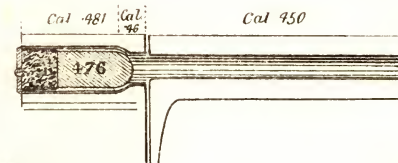


FIG. IX.
REVOLVER RANGE.

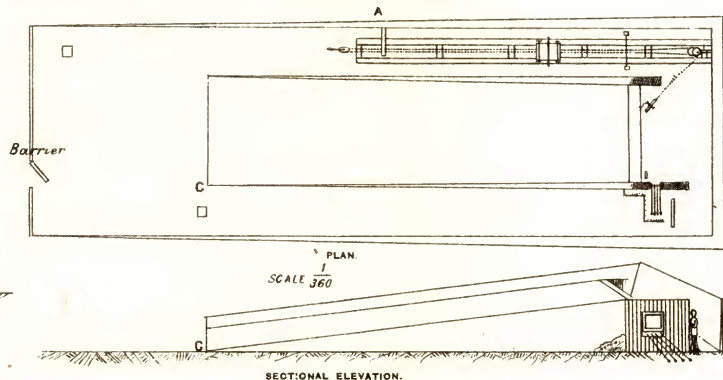


FIG. XII.

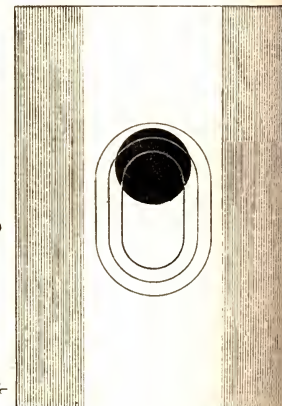


FIG. VIII.

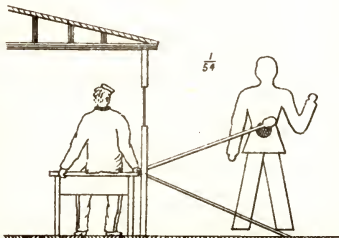


FIG. X.

RUNNING MAN AS SEEN WHEN
COMING DOWN THE RANGE.

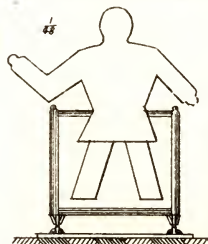


FIG. XI.

RUNNING MAN BEFORE STARTING
AND AT END OF RUN.

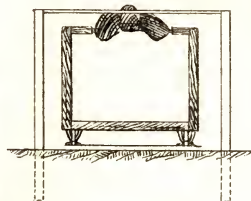


FIG. I.
TYPE OF SOLID FRAME. SINGLE ACTION REVOLVER.

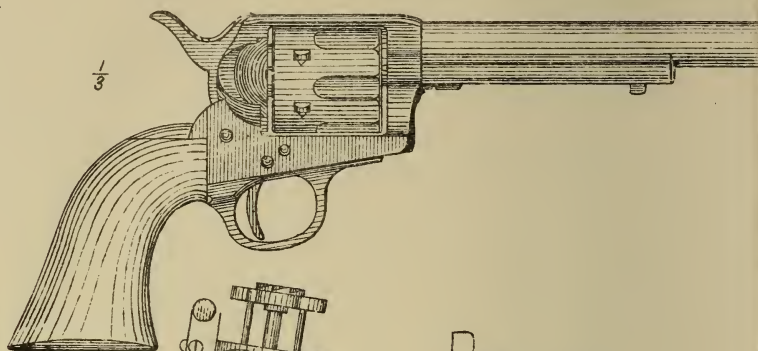


FIG. II.
TYPE OF JOINTED
SELF-EXTRACTING REVOLVER.

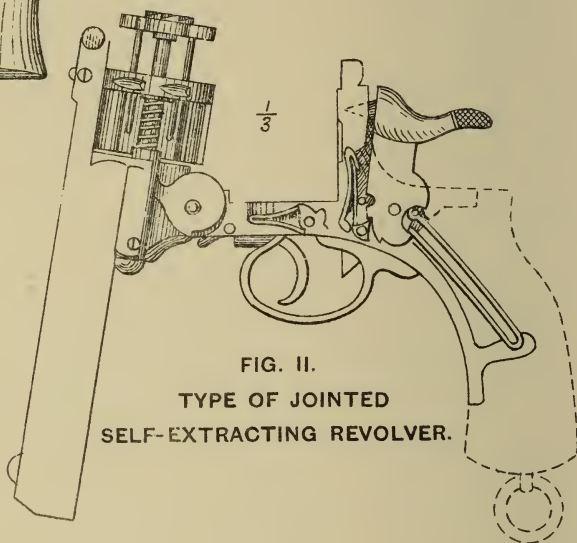


FIG. VIII.

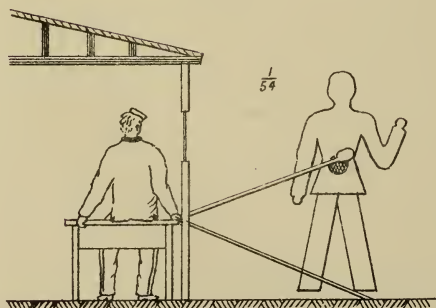
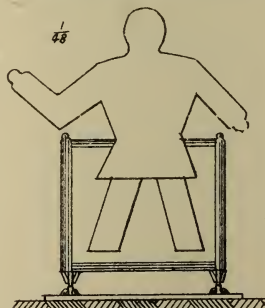


FIG X.

RUNNING MAN AS SEEN WHEN
COMING DOWN THE RANGE.



four of his assailants so discouraged the remainder that they permitted him to proceed on his way unmolested.¹

Perhaps one of the noblest opportunities of displaying gallantry is in rescuing a comrade at the risk of one's life. A good revolver shot may often succeed in doing this, where a bad one would be not unlikely to add his own loss to that of his comrade.

Again, a revolver, from its shortness and single and double action, is a very dangerous weapon. In the Far West this is recognized to such an extent that it would be a breach of etiquette for a man to touch a friend's revolver, however close it may be to his grasp.

On the Congo, not long ago, a missionary severely wounded himself in the leg with his own revolver.

Many of us here this afternoon will remember how Colonel Gonne was accidentally wounded at Hounslow, just before the Zulu campaign.

If, then, accidents like these can and do happen where men are cool and collected, how much more likely are they to occur in the heat and excitement of action.

Should the Revolver be carried on Service?—It is urged sometimes that the revolver is too dangerous a weapon to be used in practice; but if so it should not be allowed in war.

Whether a revolver should be carried or not on service is still an open question. Some advocate its entire disuse, others that it should be confined to the Staff and cavalry.

No doubt to a mounted Officer the possession of a revolver and the ability to use it may often be of great value. There are times, too, such as at Abu Klea and Tammai, when the infantry Officer may turn the weapon to account. Colonel Byam, C.B., York and Lancaster Regiment, who has had considerable experience, writes on this point as follows:—"I think a revolver is better than a double-barrelled pistol, especially for an Officer who has to perform his duties on foot.

"My experience in the Soudan, 1884, goes to prove that an Officer may get into a scrimmage, and be surrounded by a number of the enemy, when he might require more than the two shots he would get with a double-barrelled pistol before he could free himself. I had a six-chambered Royal Navy revolver at Tammai when the Arabs rushed the 2nd Brigade square. I was at the corner of the square formed by my battalion when the rush came, and my men were forced back. I fired into the faces of two Arabs, and was then knocked over on my back. In this position I fired again; on regaining my feet, I was surrounded by Arabs, and fired my other three barrels into the faces of men close to me. Several men of the regiment came to my rescue, and I found an opportunity to reload, and was again in a position to fire, which luckily I had not to do. Loading did not take more than one minute. . . .

"I certainly think Officers should be trained to shoot with the right and left hand at distances less than 25 yards with a revolver cocked, and also half cocked, pulling the trigger from half cock and firing.

¹ Scott's "Partisan Warfare."

"A careless or excitable man *may* use his revolver at a wrong time, but anyone accustomed to handle one should not do so.

"I heard of no instance of the Royal Navy pattern of revolver getting out of order; there were, however, some intricate patterns that were reported to have jammed. I always looked to mine after a march, and again before settling for the night.

"I may remark that shooting at distances over 25 yards is a mistake. I recommend practice at 10 yards. On service it is better to reserve your fire till within 5 yards of your enemy. A mounted Officer might find a double-barrelled pistol very useful."

Again, Colonel Gilmore, in his "Four Years in the Saddle," says: "We had nearly all got through a fence when I saw Kemp engaged with a powerful fellow, who was closing in upon him with sword upraised. Kemp always carried two pistols; in one he had but one load; that he fired at his adversary, but missed, then threw the pistol at him and struck him in the breast. The trooper closed in upon him before he could draw his second pistol, and seizing him by the hair, tried to drag him off the horse, at the same time lashing him across the shoulder with his sabre. Kemp held down his head and took it, all the while trying to draw his pistol. I had cut my way to him, and had raised myself with uplifted sabre to cleave the fellow's skull, when Kemp discharged his pistol into his stomach, and he was free."

Those who advocate the entire disuse of the revolver admit freely that at times it is of value, but urge that this value is more than compensated by the mischief which, either through accident or ignorance, it may occasion. A General Officer commanding a brigade in Egypt told one of his regimental Officers who had a revolver in his hand to put it up and look after his men, not himself, and that his men would look after him.

Among the adherents of the revolver great differences of opinion are found as to which is the best weapon, some being in favour of one, some of another.

The double- or four-barrelled pistol also has many friends: they urge that they are simpler, that they possess more stopping power, and that, owing to the striker revolving and not the barrels, their mechanism is able to be better protected from the effects of the weather.

Sir Archibald Alison, writing on this subject, says: "Every Officer should carry a revolver on service, and as a matter of course be instructed in its use; when I say every Officer ought to have a revolver on service, I mean that he should have a weapon of that kind; but whether that should be a revolver proper or a double-barrelled pistol I am not prepared to say. On service myself I have always carried a revolver."

There is something to be said, too, in favour of smooth-bore barrels for weapons whose use is essentially at close quarters, and from which it is desired that a heavy shock to the object aimed at should be given.

Should Officers be armed with a Rifle?—In the Bechuana Expedition all Officers carried the carbine or rifle; and Colonel Leach, *U.C.*,

C.B., saved his life and that of his party by the use he made of the latter weapon in the Afghan Campaign.

Colonel Methuen, writing on this point, says: "My opinion is very divided. If an Officer is not armed with a carbine he loses a chance. If he has a carbine and makes use of it when not absolutely necessary, he may be neglecting his men.

"I do not consider it is an Officer's duty to kill; he has to superintend the action of his men.

"Fighting against the Boers as mounted infantry, I think an Officer *must* be armed. He may at any moment find to be so is an absolute necessity.

"Fighting against a European enemy, I believe he is never very likely to require a carbine, and if the worst came to the worst he could pick up a rifle *pro tem*.

"Sir Charles Warren lost two Officers in his previous expedition in Bechuanaland West from their not carrying carbines.

"If revolvers are used, by all means have an Army pattern, and have all Officers instructed in its use. I gave up the idea of any but a Martini-Henry rifle when going to the Cape, because it must be a *sine quâ non* that any arm taken on service should carry Government ammunition. But you will scarcely find one Officer who has had practical experience recommend a *revolver*; he will urge you to use a *double-barrel horse pistol*. I understand there are three objections to the revolver: it jams; the bullet is not sufficiently large to give the required shock; it delivers the fire too high. Personally I do not intend ever to use a revolver, as I mean to stick to my pair of Holland's horse pistols."

When considering the advisability of carrying the revolver or not, its moral effect should not be lost sight of. Perhaps there is no weapon which produces a greater effect in this way. A rifle when loaded may miss its aim, and when empty is useless. The revolver to an assailant is always a loaded weapon, and we require foes as brave as the Zulu or as reckless as the Soudanese to charge home when confronted by it. Again, a loaded revolver gives confidence to its possessor. If he has practised with the weapon he knows that, if held straight, six men must fall before he can be closed with; if he has had no practice with it he is equally confident, for few believe until they have tried how difficult it is to hit a man at even such short ranges as 10 or even 5 paces.

In practice the number of rounds fired is constantly forgotten, even by the marksman himself; how then can they be reckoned by an enemy in action? There are many cases of an empty revolver saving both life and property. A short time ago there was an account of a lady who, by presenting an empty revolver at a burglar, prevented his escape.

Lastly, it must be remembered that the question of revolvers *versus* pistols has been studied in other countries besides our own, and the result has been the universal adoption of the revolver.

II.—*Necessity for Training Officers in the use of the Revolver.*

No doubt many Officers in our Army are good revolver shots, the results of the annual inter-regimental revolver contests (established some time back by Major Salmond, Royal Scots Fusiliers) show this to be the case in peace: last year the winning Officer, Major Harley, the Buffs, scoring 57 out of 60 points. On service too there are numerous cases when Officers have shown their proficiency with a revolver. Captain Burn-Murdoch, of the Royals, who, with his legs jammed under a dead camel at Abu Klea, succeeded in killing four or five Arabs, who attacked him while in this critical position, is a case in point. But there are a great number of Officers who know little of the weapon, and some who know nothing at all.

Major King-Harman, B.S.C., lecturing at Simla last year on the subject, says: "It has always seemed to me a very strange thing that, although there is constantly continued and even increasing expenditure of time, trouble, and money on the instruction of the rank and file of the Army in the use of their weapons, yet no attention whatever is paid to the actual fighting capabilities of the commissioned Officers; and it seems to be taken for granted, either that they are quite perfect in the use of their weapons, or else that skill in the use of them is a matter of no importance."

Manner in which Revolvers are often purchased.—Of late years many Officers have been suddenly ordered on services of a nature when a knowledge of the revolver would have been of the utmost importance to them. On receiving their orders, those not in possession of revolvers hasten to town, and purchase a so-called "regulation revolver," good, bad, or indifferent, as fortune may decide.

Major McClintock, writing in the "Field," says: "Although the revolver has come into so general use, there is probably no weapon which is so little understood, and in the purchase of which the customer is so entirely at the mercy of the gunmaker from whom he buys it. Very few purchasers of revolvers understand the merits of the different types of these pistols which are offered for sale, and a still smaller number have the opportunity of testing the mechanism or the power of the weapons they buy. But there is no arm which should be selected with greater care, as when required for use the owner is generally in extreme peril and the failure of his arm may cost him his life."

On the Officer returning with his purchase, he may, if time permits, pay two or three visits to the nearest range, when a hasty practice is attempted (it was during a practice of this sort that Colonel Gonne was wounded), or, if time does not permit of this, he contents himself with what practice he can get in fine weather during his passage out. Now, in these days of progress, should such a state of things be possible?

Amount of Instruction our Officers receive in Self-defence.—Down at Sandhurst we teach the young Officer to command a brigade, to build a fort, to survey a country, to ride a war horse, and to climb a pole, but the only authorized course of personal defence or offence are ten

short lessons in sword exercise; that these lessons should teach anything more than a few parade cuts and guards is hardly to be expected.

After getting their commissions a three months' course of gymnastics is gone through: during which, if the classes are not too large, a few more lessons in sword drill are given.

The outcome of this and other training is that fine display known as "sword exercise" at General's Inspection, which, though imposing to the crowd, is well known to be more or less useless for all practical purposes.¹

Colonel Crookshank says on this point: "As for the sword exercise, in my own experience that has been an annual farce; I have commonly seen the Inspecting General turn his back on the performance, as being too painful to be witnessed."²

Colonel Onslow on Self-defence.—Colonel Onslow, Superintendent of Gymnasia, writing on this subject, says: "I think that all Officers should be instructed in the use of the revolver, and the cadets might be taught how to handle it at Sandhurst, and also upon first joining their regiments, as, if once properly taught how to use the weapon, they would require but little practice afterwards to enable them to defend themselves in a scrimmage. It is the infantry Officer's only weapon. I don't think he would care to depend on the regulation sword for his protection, and besides I do not believe that one infantry Officer in ten ever learns how to use a sword, and it is not, in fact, a weapon which can well be used on foot; at least such is my opinion. However, I may be wrong, but at any rate I have rarely met with men who have been at all handy with a sword, dismounted. A man may be very good with a single stick, but a duffer with a sword."

Sir Francis De Winton, also writing on this subject, says: "Except for parade purposes, or for cavalry, a sword is a useless and foolish weapon, and a revolver in the hands of a confident and practised man would be a far more efficient weapon for either offensive or defensive action. In fact, there cannot be any comparison between them.

"With reference to shooting, I have seen very fair practice made with a revolver in the hands of a man accustomed to use and handle them.

"I have known several instances where accidents have occurred from want of a proper knowledge, and I therefore consider the revolver is a dangerous weapon to every one when the owners do not know how to handle them.

"A course of practice or instruction in the use of revolvers could not fail to be useful, because it would give confidence and knowledge, and a certain amount of practice would naturally increase efficiency in shooting."

Unlike Continental armies, we have no course of revolver shooting for Officers, and therefore, officially, an infantry Officer can hardly be expected either to defend himself or assail a foe. Now how has this

¹ Since writing the above I have learned that General Roberts has substituted single stick and revolver practice in India; could we not follow in his wake?

² "Pioneer," 22nd July, 1885.

state of things arisen? Possibly this way: in the days of our fathers every Officer knew he was liable to be called out, and consequently that his life might depend upon the turn of his wrist or the steadiness of his eye, he therefore constantly practised both with sword and pistol, and the results arrived at with the pistol were little short of marvellous; cutting out the ace of diamonds at 12 paces, shooting a swallow on the wing, if not everyday occurrences, were at least not unusual. Shooting like this can never be expected with the revolver, but a fair shot ought to be able to place every bullet within a target 1 foot square at 30 yards distance. Duelling being still carried on in Continental armies, it no doubt serves to keep up the knowledge of self-defence. With us, however, the old custom of pistols for two and coffee for four has passed away, and with its departure comes the necessity for some course of training both with pistol and sword.

III.—*Scheme for Instruction of Officers.*

Proposed First Course of Instruction.—Out of the 300 gentlemen cadets now at Sandhurst, 246 pay 10s. per term for the privilege of practising in their own time with the revolver. Many of them become good shots, but others no doubt get tired of the walk to the range, and leave the College with as little skill in revolver shooting as when they entered it. The drier portions of the subject, such as taking to pieces, and cleaning the weapon, it would be quite useless under present arrangements to attempt to teach.

If, however, the authorities could see their way, while retaining the voluntary nature of the practice, to allot 200 marks (the same as is now given to riding and gymnastics) for proficiency in the use of the revolver, there would not be a cadet in the College who would not practise frequently.

In the event of marks being thus awarded, it would be necessary to open the subject to all cadets by making the charge compulsory. This charge, which would include examination, instruction, marking, and 100 rounds of ammunition to each cadet per term, would not exceed 10s. per head.

Major Savile, Professor of Tactics at the Royal Military College, writes on this subject as follows: "Concerning revolver shooting and instruction, it is my opinion that, if it is desirable that an Officer should know how to defend himself in action, it is obviously equally desirable that he should be taught the best means of so doing.

"If the matter is considered merely from a tactical point of view, it can hardly be denied that the preservation of the lives of our Officers during an action is of the highest importance, in order that the men may be properly led and directed, and that the plan conceived by superior authority may be correctly executed.

"Although actions in modern Continental warfare may be said to be mainly carried on at long range, and therefore during the greater part of a battle the sword and revolver carried by an Officer can hardly be looked upon as anything but encumbrances to his free action, still local fights in villages, woods, and enclosures almost invariably occur

in the course of a long action, and if an Officer so engaged leads his men properly, and sets a good example, it is certain that he will have to defend his life by the use of his sword and revolver; that the cases in which this will occur in savage warfare will be infinitely multiplied, is a fact patent to all.

"For these reasons, I strongly approve of any measures which will tend to promote good revolver shooting amongst our Officers.

"I fail to see any good cause why your scheme for introducing revolver shooting at the Royal Military College as a voluntary subject should not be carried out. I do not consider that the practice would in any way interfere with the instruction in other subjects, there is ample time available for it, and I am sure that regulations could easily be framed for conducting it in an efficient and practical manner."

Major Scott, Professor of Fortification at the Royal Military College, writes: "My idea is that a cadet should be instructed at a military school in those subjects which will make him ready to join his regiment as an efficient subaltern (not General) Officer.

"What subject can be more practical or useful than shooting? I agree in the main with your revolver practice scheme. Experience alone can test its practical working. I quite agree with you as regards the award of marks for practice. I personally should like to see this principle extended to rifle shooting as well.

"Shooting is a subject to which an award of marks is eminently suited, because their distribution must be fair, inasmuch as the amount allotted does not depend upon the fads and fancies of various individuals, but upon an actual score obtained at practice by individual exertion.

"Some years ago it was suggested that marks should be allotted to all athletic accomplishments, but a fair system of marking for proficiency in cricket, rackets, &c., presented an insurmountable obstacle.

"Such is quite the reverse with rifle shooting: points obtained count as marks 'et voilà tout.'"

Colonel Abbott Anderson, Professor of Surveying at R.M.C., writes: "I have perused your scheme for revolver instruction and for awarding marks for revolver shooting, and in the main I agree with your suggestions, and am decidedly of opinion that instruction in this most useful military accomplishment should no longer be neglected."

The old French proverb about omelettes and eggs must not be forgotten in considering whether cadets should be trained in the use of the revolver. The weapon is a dangerous one, and, though practice has been carried on for two years at the Royal Military College without accident, still it is not to be expected that one will never happen. Now, is the game worth the candle?

On the one hand we have our Officers trained to defend themselves when on service. On the other, the possibility of an accident at home. Surely the accidents which constantly occur from want of early training will more than compensate for the risk on a carefully superintended range.

Changes in Ammunition.—Of course this first training ought to be kept up. Here a difficulty arises; all Officers join with swords, some with revolvers as well. These latter find that not only *revolvers* change, which would be a small matter (because, though their revolver might not be the best obtainable, they would know its shooting powers and other capabilities, and be quite prepared, if need be, to trust their lives to its care), but that the Service ammunition changes even more frequently.

An Officer who took one of Webley's revolvers to the Soudan, chambered to fit No. I Mark Government ammunition, did not find out, until he was actually engaged with the enemy, that the new ammunition was Mark III, which could not be induced to enter his revolver. Finally, he threw his revolver at an Arab whom it hit in the face. It was picked up none the worse some three weeks later, and is now in England.

During the last few years we have had no less than three different sorts of Government ammunition, some of which fits one revolver, some another, and the owner of a revolver often finds to his dismay that his outlay has been wasted. This is discouraging to would-be purchasers, and some means should be devised for meeting the difficulty. Would it be possible for the Government to have in stock a sufficient number of proved revolvers, to supply not only the non-commissioned officers, but also all Officers ordered on active service? The advantages of this would be: 1st, That all Officers would be armed with the same class of weapon, as is the case in all Continental armies. 2nd, That Officers who like to be always ready for active service would be saved considerable expense. 3rd, That by issuing a few of these revolvers to each battalion there would be no obstacle to Officers going through an annual course of revolver shooting. 4th, As the Government ammunition is made for the Government pistol, there would be no danger of the one not fitting the other.

'Major King-Harman, in his lecture speaking of Officers' revolvers, says: "I am given to understand that orders will shortly be issued for all Officers to fire twenty-four rounds annually from revolvers at present in their possession, which will get them into the habit of firing off such weapons as they have got; but when the time comes, I strongly suspect that in too many cases the revolvers are very much like the swords, useless gimcrack things, that will not take Government ammunition, and that the private-made ammunition used with them is harmless rubbish that has been kept for years.

"Trained Officers don't grow like leaves on a tree, and in native regiments they are so few in number and so difficult to replace that everything should be done that is possible to preserve their lives."

Besides a short annual course, during which single and continuous right- and left-handed practice should be carried on, Officers might be encouraged to practise voluntarily by the construction of revolver ranges in or near the barracks. A space of 45 yards by 12 yards is sufficient for these ranges.

¹ "Pioneer," Simla.

In time, too, our present sword exercise at Generals' inspections might give place to more practical work, such as fencing, single-stick, or revolver shooting.

It would not appear necessary that an Officer should acquire all these exercises, but it is certainly to be wished that he should be fairly proficient in one or other of them.

Insufficiency of Annual Course.—With regard to non-commissioned officers, drivers of artillery, and others, who are armed with the revolver, some pains should be taken to teach them the construction and use of the weapon with which they are armed.

At present an annual course of twelve rounds is laid down for non-commissioned officers, but this is clearly inadequate to insure even fairly good shooting. At Abu Klea the sergeant-major of the Guards threw away his revolver and took to a rifle, perhaps the best thing he could have done under the circumstances.

IV.—*History of the Revolver.*

The first revolver dates back to about the 16th century; these first revolvers were of very primitive construction, and, following on the same lines as the revolving musket, which had been invented some time previously, were very clumsy weapons, taking more time to cock and revolve by hand for each discharge, than is now taken in loading and firing a breech-loader. I have here a curious relic of the past in the shape of an old revolving matchlock, kindly lent me with other revolvers by Mr. Wilkinson of Pall Mall. This weapon dates back to about the 16th century, the cylinder is revolved by hand, and the piece is discharged by means of a slowmatch; the stock passes under the arm in the same way as the matchlocks of the Sikhs and Afghans. It is probably of a weapon of this sort that Mr. Pepys writes in his diary, 4th March, 1664: "There are several people trying a new-fashioned gun, brought my Lord Peterborough this morning, to shoot often one after another without trouble or danger."¹

America may be said to be the birthplace of the modern revolver, and Colonel Colt its father; his weapon was for many years far ahead of English revolvers, and though Dean and Adams, and others in this country, expended much time and ingenuity on the subject, they at first made little way.

This was chiefly due to our English makers attempting the difficult task of combining the rotation of the cylinder with the action of pulling the trigger, and thus ensuring the greatest possible rapidity of fire.

Colonel Colt, on the other hand, very soon succeeded in causing the cylinder to rotate by the cocking of the hammer; he thus obtained a fair amount of rapidity with greater accuracy of fire than the English single-trigger action revolvers could hope to arrive at (Fig. 1, Plate XXVI).

Double-action Revolvers.—When, however, the idea of combining the American cocking action and the English trigger action in the

¹ United Service Journal.

same weapon, that is to say, in a double-action revolver, which might be cocked between each discharge, or discharged continuously at pleasure, was entertained, the English gun makers, who had already developed a smooth trigger action, advanced with a bound to the girths of our Yankee cousin, and a hammer and tongs race has ever since been run as to merit between American and English revolver makers.

The old pepper-box revolver, of which I have an example here, was one of these; its trigger action may be noticed, showing at what an early stage our English makers had arrived at a smooth pull-off. The old wheel pistol is another example of the early percussion type—it was a great novelty in 1839, and large numbers were made; the rebounding lock of this pistol is worthy of note.

Difficulties in manner of igniting the Charge.—Another difficulty which the earlier inventors had to struggle with was the manner of igniting the charge. In the Tower collection there is an example of a matchlock revolver; and many types of flintlock revolvers are still to be found. The percussion cap was of great assistance to the revolver makers, but the exploded cap often jammed the weapon, and it was not until the pin-fire cartridge was introduced that the revolver could be at all depended upon. After the pin-fire came the rim-fire cartridge, and this has now been superseded by the central fire.

In 1835 Colonel Colt patented his revolver, but it was not then the simple and useful weapon it has since become.

During the Crimean War and the Indian Mutiny the revolver, notwithstanding its imperfections, was frequently used with effect.¹ Major Lumley, V.C., on entering the Redan on September 8th, 1855, was immediately attacked by three gunners who were reloading a field piece. He drew his revolver and shot two of them, he was then knocked down by a stone. Again, in the Mutiny at Chota Behar, Colonel Daunt, V.C., rushed forward and, assisted by Sergeant Dynon, succeeded in capturing a gun by shooting the gunners at close quarters with his pistol.

Double-action Revolvers.—About 1855 Adams and Tranter brought out their double-action revolvers; they were at the time considered very superior to the single-action.

An Officer, writing in the "Field" of February 16th, 1884, says: "The revolver that I carried through the three campaigns of 1877, 1878, and 1879 in South Africa behaved as well as I could wish. This was a double-action revolver by Tranter, and although I carried it over some thousands of miles' rough travelling (in the saddle) I did not find it fail me once." But, notwithstanding this, a feeling appears to be growing that double-action revolvers, from their delicacy of construction, and liability to get out of order, are not suited for rough usage.

Colt's Single-action.—In Canada and the Rockies Colt's single-action frontier revolver is most generally met with. With this weapon the cow-boys are generally armed, and the practice they make is truly remarkable; they have also a curious knack, when rapid firing

¹ "V.C. Records."

is required, of supplying the double-action deficiency, they allow the pistol after each discharge to drop from their hand, retaining only hold of the trigger guard by the finger, the weight of the pistol and a slight jerk causes it to describe a circle, of which the finger in the trigger guard is the centre; as it comes back to its original position, the hammer is caught by the thumb, and the weapon cocked and again ready for use.

The time taken in extracting the cartridges, and loading Colt's and other solid frame revolvers, has been attacked with more or less success by both English and American makers. Colonel Silver has produced a solid framed rapid extracting revolver of some merit, while Webley, Wilkinson, Kynock, and others in this country, Smith and Wesson in America, have devoted their attention to producing jointed framed self-extracting weapons. (Fig. 2.)

Heavy Charges.—There is no doubt an impression that a self-extracting revolver cannot safely fire such a heavy charge as a solid frame revolver of the same weight, but when we consider the heavy charges fired by jointed express rifles this seems to be straining at a gnat and swallowing a camel. Again, the Enfield and other self-extracting revolvers have about the same recoil with their 18 grains of powder and 265 grains of lead as the American cavalry revolver with 37.6 grains of powder and 250 grains of lead.¹ This goes to show that the strain on the two weapons is about the same, and when it is considered that the 18 grains of powder in the Enfield has to force a 0.476 bullet first through a 0.460 cylinder and then through a 0.450 barrel this is hardly to be wondered at. It must also be remembered that the revolver employed by the Russian cavalry is a self-extracting weapon, which safely carries a charge of 27 grains of powder.

Quite recently Mr. Webley has brought out a new self-extracting revolver, with the joint and top fastening of such solidity that over 100 rounds of the American cartridge, containing 3.76 grains of powder and 250 grains of lead, has been fired from it without inconvenience to the marksman or damage to the weapon.

Fouling.—Before breech-loaders were invented, fouling was a serious drawback to the efficiency of the revolver, and many systems of lubrication by Tranter and others were tried to surmount this difficulty.² It has now been altogether overcome by the employment of a lubricant contained in the cannellures of the bullet, which may consist of tallow or Japan wax.³ A Colt's revolver has fired 300 rounds with American Service ammunition, being allowed to cool after each 100; no difficulty was experienced in firing it. The revolver was then laid in the snow, water poured over it, and it was allowed to remain in the weather three days and nights. When taken up again it was rusted considerably, but worked perfectly.⁴

¹ Major McClintock's experiments.

² Greener, page 427.

³ United States, Springfield Report, 1882.

⁴ Extract from American Government Report on trials with breech-loading revolvers.

Fouling of the Pin of the Cylinder.—In the earlier types of self-extracting revolvers it was found that after firing a certain number of rounds, the gas escaping between the cylinder and the barrel fouled the pin of the cylinder to such an extent that the cylinder would not revolve. This difficulty has now been successfully overcome by Mr. Webley and others, and a self-extracting revolver has fired over 300 rounds without a sign of fouling.

V.—*Rapidity of Discharge.*

With regard to rapidity of fire, it must be remembered that a non-extracting double-action revolver can be fired as rapidly as a self-extracting revolver for the first six rounds; but when the reloading question comes in as part of the attainment of quick fire the latter weapon leaves the former hopelessly in the rear.

Whether the facility afforded for quick loading by the self-extracting revolver is of the value it appears to be at first sight seems to be doubtful. There are few cases, looking at it from a military point of view, when six shots would not be sufficient to settle the affair one way or another.

Again, though a self-extracting revolver takes very little time to reload, still it does take time, and it appears probable that that delay would in most cases be as fatal to its possessor as the rather longer period taken by the non-extracting weapon.

It has been stated that a self-extracting revolver can, by being placed in the holster, or stuck in the coat-front, be rapidly recharged with one hand while the marksman is proceeding at a gallop; of course, if this can be done, it is a point in favour of the self-extractor.¹

Colonel Maitland, R.A., writing from Turkish headquarters in 1878, says: "The revolver carried by the Circassian body-guard is a serviceable weapon. It opens at the breech on a hinge, and is so contrived that the action of opening throws out the empty cases; the barrel is then thrust, muzzle downwards, into the breast, the hinge remaining open; fresh cartridges are placed in the chamber. The breech is closed sharply by a snap. The pistol is then withdrawn ready for use. All this can be done at full gallop with one hand in a very short time."

The time taken by expert marksmen to fire and reload non-extracting revolvers is also short. Eighteen rounds have been fired, commencing and ending with chambers empty, in 1 minute 54 seconds, with a Colt revolver.²

It is not the extracting apparatus which oftenest renders a revolver unreliable, it is the failure of the cylinder to revolve properly. Many Officers on this account prefer the double-barrel pistol for active service. For the Afghan and Egyptian campaigns nearly all the Officers of the 10th Hussars armed themselves with these pistols instead of revolvers.

¹ "Encyclopædia Britannica."

² Springfield Report, 1882.

Reasons why the Cylinder sometimes fails to rotate.—The failure of the cylinder to rotate will generally be found to be due to one of two causes :—first, faulty construction in the revolver ; second, faulty construction in the cartridge.

In the first case, when revolvers jam it is due to the ratchet not being properly hardened. This wearing of the ratchet is so well recognized that I find in Dean and Adams' description of their revolvers the following :—"The toothed ratchet is secured to the base of the chamber by two screws, so as to admit of its being renewed when it becomes abraded by use."¹

A good ratchet, however, will last a long time ; over 5,000 rounds have been fired by a Wilkinson's extracting revolver before the ratchet showed any signs of wear.²

The ratchet in American revolvers appears to be flatter, stronger, and more deeply cut than those employed in England.

The hand or pawl has also two fingers in place of one, the second finger taking hold of a second tooth, and greatly assisting the revolution of the cylinder.

Another cause which sometimes accounts for the non-rotation of the cylinder is the wearing of the pawl or lifter, which shortens it and prevents it working properly.

A cause of miss-fire is the wearing of the striker, which of course shortens it, prevents its reaching and exploding the cartridge.

In the second case the butt end of the cartridge is sometimes accidentally elongated, and this catching in the breech piece prevents the cylinder revolving. Sometimes a paper coating is placed within the metal case of the cartridge, and this on discharge gets wedged between the cylinder and the barrel, causing them to jam. There were instances of this in Egypt.

Besides the complete jamming of the cylinder, miss-fires occur from the cylinder rotating either too far or not quite far enough, the hammer in these cases striking either behind or before the cap.

The weight of the loaded cartridges when two or more chambers have been discharged will sometimes thus drag the cylinder over.

Of course much greater rapidity can be obtained with a double-action revolver fired continuously, that is, without cocking, but by simply releasing the trigger after each discharge, than with the same weapon when fired at single practice, that is, when cocked by the thumb between each round. And there are times when this rapid firing may be of the utmost importance.

But care must be taken to guard against rapidity taking the place of accuracy ; it is much easier than most people think to miss a man, even at 5 or 10 yards ; the smoke alone after three or four rounds will often completely obscure the view.

Advantage of Continuous over Single Practice.—A great advantage which continuous practice has over single is that it enables the revolver to be discharged repeatedly with one hand with great ease. Thus an Officer may have his sword in his right hand, and yet fire

¹ Greener.

² R. M. C. Range.

his six barrels with his left; if mounted, he can hold his reins in his left hand and empty his revolver with his right. It is curious how little difference single or continuous practice makes in point of accuracy.

In the Musketry Regulations it is laid down that single practice should be the rule, continuous practice the exception, and this is now carried to such an extent that there is no continuous ball practice in the non-commissioned officers' course, although it was very strongly recommended that there should be.

My experience goes to show that continuous practice should be the rule, single practice the exception; when I say this, I do not mean that the revolver should necessarily be fired rapidly, indeed a steady aim should always be taken, but that continuous practice should be generally used even when time is no object.

My reasons for this are, first, that I consider continuous practice far more useful for an Officer than single practice; the latter would only be used for long shots, which would, in many cases, be better left unfired. Second, the most probable times when a revolver would be of use to an Officer would be at close quarters to repulse, or protect himself from, a sudden rush of the enemy. In this case continuous practice would be the order of the day. Third, continuous practice is more difficult to learn than single, and therefore should be more studied. Fourth,—after a short time, as good, or almost as good, shooting may be made with continuous as with single practice. In an account in "The Field," of some interesting revolver experiments made at Nunhead (on 28th March?) by Mr. Webley, his single practice at 12 yards was not so good as his continuous at the same distance.

Mr. Webley professes to be able to make as good shooting with continuous practice as at single; and I have come across many cadets who can do the same.

At these same trials Mr. Webley fired, continuous practice, forty-eight shots in 3 min. 5 sec. (with a self-extracting revolver), all but four shots striking within a square foot; range, 12 yards. Curiously enough, on the 9th April, Mr. Ira Paine, at the same place, under the same conditions, with a solid frame Colt, fired 48 shots in 2 min. 15 sec., but his diagram was not so good as Mr. Webley's.

When several shots have to be fired at an advancing target, I believe better shooting can be made continuously than when cocking after each shot, the disadvantage of the heavier pull in the former case being more than balanced by the advantage gained by keeping the eye constantly fixed on the target, and the revolver pointed more or less the whole time in the same direction.

Left-handed Shooting.—The importance of left-handed practice must be mentioned; to a beginner it will appear that shooting with the left hand is extremely difficult, but this is by no means the case; with a little practice, almost as good shooting can be made with the left as with the right hand, and the advantage of being able to do this must be apparent to all. It is urged that it may be very true with regard to the infantry Officer, who would

naturally, if a good shot with his left hand, carry his revolver in his left and his sword in his right, but that a mounted Officer would always have his reins in his left hand, and therefore only have his right available; but there are cases, a hard-pulling horse for instance, or an enemy close on the near side, when the power to shoot with the left hand would be of value. Sir Richard Taylor, K.C.B., writes: "The proposal that Officers should be instructed in the use of the revolver is one that in my opinion is well worthy of consideration, as there may occur many occasions on active service when proficiency in the use of that arm may be most useful. It is a mistake to suppose that a revolver can be used effectively without some amount of practice and tuition. I would also advocate that the use of the weapon should be taught with the left as well as the right hand."

A Staff Officer now serving in Egypt also writes: "I certainly think Officers should be instructed in revolver shooting as part of their training; they ought to be so, to enable them to defend themselves and also to accustom them to handle revolvers, and then we should not have so many accidents with them. I have been accustomed to shoot with revolvers and pistols ever since I have been in the Service, and made a point of making myself a fair shot. Every Officer should be able to shoot with his right or left hand as occasion requires."

The following incident is taken from Denison's "History of Cavalry":—

"In the battle of Saitshar, a Servian Officer, Captain Frassanovitch, distinguished himself greatly. He took his sabre in his teeth, and, revolver in hand, charged through a Turkish demi-battalion, captured the colours and carried them off, leaving a dead or wounded Turk behind him for every barrel of his weapon."

VI.—*Accuracy.*

It is difficult to lay down a cut-and-dry law with regard to the accuracy of the revolver, so much depending on the powers of the marksman. The Volunteers have lately seen the importance of accurate revolver shooting, and last year there was a revolver competition at Wimbledon for the first time. The attempt, notwithstanding some drawbacks, which will always attend a new venture, proved a great success, and is to be followed by a competition on a larger scale this year. The accuracy of the shooting, however, left much to be desired.

There is no doubt that the best revolver practice of the present time is far inferior in point of accuracy to the pistol-shooting of our fathers; partly this is no doubt due to the weapon; most revolvers are badly balanced, the better ones in this respect, such as Colt's Frontier, having too long a barrel for convenient portage.

Again, in the old duelling pistol, and in the modern rifle, the recoil acts more or less directly in a line with the hand or shoulder, whereas in the revolver it acts considerably above the hand, thus giving the

weapon an upward jerk, which, though perhaps not affecting the accuracy of the first shot, tends certainly, from the strain on the wrist, to impair the accuracy of those that follow.

Want of Interest in Revolver Shooting.—What perhaps is the chief cause of the poor, nay wretched, revolver shooting of the present day is the little interest taken in the subject. The old saying that “practice makes perfect” holds good in revolver shooting as well as in other matters, and, unless we can induce our Officers and others to exercise themselves in the use of the revolver, there will be little good in attempting to improve the defects of the weapon.

What may be done by a practised marksman, the following extract will show¹:—

“On Friday last we went by invitation to Nunhead to see Mr. Ira Paine demonstrate what a good shot can do with a revolver. The day was anything but favourable, the light being gleamy and dazzling, and a north-east wind blowing in powerful gusts from left to right across the range. Mr. Paine stood in a hut which offered some little protection from the wind, but the full flight of the bullet is across the open. The targets used were the ordinary cartons, with a bullseye $4\frac{1}{2}$ inches in diameter. The distances were measured by us. The first practice was at 12 yards, the weapon being a Colt’s short army revolver with a barrel $5\frac{1}{2}$ inches long, taking Eley’s 0.450 cartridge. The first shot struck the bullseye about half an inch low from the centre, the second was a dead centre, the third a quarter of an inch low, the fourth one-eighth inch low, the fifth three-eighths of an inch low, and the sixth one-third of an inch low on the right, all being bullseyes. In short, the number of shots fired was fifty, and resulted in forty-two bullseyes.

“The wind blew the target about so that, on our suggesting it should be fastened in some way, Mrs. Paine stepped forward, and, taking hold of one corner, held it steady. Under favourable circumstances, it is fair to suppose that every shot would have been a bull.

“The next arm used was the ‘Frontier,’ having a barrel $7\frac{1}{2}$ inches in length, and taking the 0.44 calibre Winchester Repeating Arms Company’s cartridge.

“The first shot was a bull 1 inch low from centre, the second one-fourth inch right, the third one-eighth inch high, the fourth one-eighth inch left, high, the fifth an outer, the sixth (a careless shot) 2 inches high. All bulls but the fifth.

“Twenty-five shots were altogether fired, of which twenty-three were bulls. At 25 yards with the short Colt Mr. Paine made eight splendid bulls and seven outers, four of which were within half an inch of the bull.

“The exhibition closed with the ‘Frontier,’ at a third-class firing target, with a bullseye 2 feet by 9 inches.

“Distance 100 yards. Six shots were fired. The first was a bull 2 inches low, right; the third 4 inches low, left; the fourth, outer, left, 3 inches from bull; the fifth an outer, left, half an inch from bull; and the sixth a bull, 2 inches low, left. This is splendid

¹ “Shooting Times,” April 25th, 1884.

shooting, and we regret exceedingly that the adverse conditions of the weather should have so interfered with this wonderful record."

At the last Wimbledon competition the best shooting record was made with an Enfield revolver, thirty-four points having been made out of a possible thirty-six.

But, notwithstanding the drawbacks in construction, it may be safely stated that in the hands of an ordinary practised marksman a revolver will put every bullet within a target 1 foot square at ranges varying from 10 to 30 yards according to proficiency, and this for all military purposes would appear to be sufficiently accurate.

Drift.—The twist of the rifling being to the left, the drift is in the same direction; it amounts to about 30 inches at a range of 300 yards. For distances under 150 yards, however, the pull on the trigger, acting in the opposite direction when shooting with the right hand, serves to neutralize the drift; when shooting with the left hand allowance must be made for their combined effect.

Construction of Butt.—It is curious to notice the different shape of handle adopted in most English revolvers as compared with that in general use in the United States. The handles of the former are of almost uniform thickness throughout, while those of the latter increase considerably in circumference towards the butt. Opinions and tastes vary considerably with regard to the best form of butt. In considering the subject, the two most important points to be remembered are—1st, Which butt affords the best grip? 2nd, Which sort of butt conduces most to lessen the effect of the recoil? An English saw-handled butt no doubt gives the firmer grip, while the American, on the other hand, reduces the shock of the recoil by allowing the pistol more play.

Simplicity of Construction.—Simplicity of construction is of greater or less importance in a military revolver in proportion with the intelligence and attention of the possessor. To be of any value, nay, not to be rather a danger, a revolver of any description must be thoroughly understood.

Knowledge of the Mechanism of Revolvers necessary.—A friend of mine was ordered in 1879 suddenly on transport service from Lucknow to Kabul. He had no revolver, but, thinking one necessary, he borrowed his Adjutant's. Some time elapsed before he had either time or occasion to try it. Fortunately for him, an opportunity of a peaceful nature came in his way. Passing along the Kurrum Valley with his train, he one day observed a fox, which, with sad sportsman-like instincts, he proceeded to stalk, and, on arriving within 20 yards of the intended victim, he began to open fire with his revolver, but, as perhaps was not unnatural, he could not succeed in getting off a round. A second attempt in camp not proving more successful, he returned the weapon to its owner, who, we will hope, if he takes it with him on service, will have better fortune. My friend then purchased a revolver, supposed to carry Government ammunition, and, being warned by experience, practised with it in camp. After the relief of Sherpore he took it with him when he went to assist in clearing the surrounding villages. In one of these he found some

Afghans, on whom, at about 20 yards, he fired six rounds, without, as far as I could gather, much result. He then proceeded to reload, and found to his dismay the ammunition he had purchased with the revolver had been expended, and the Government ammunition would not fit his new purchase. Fortunately the Afghans retired in one direction, and allowed him to perform a like movement in the other.

So much for an Officer not knowing the construction of, and failing to test the service ammunition with, his revolver.

It may appear to some that my friend's conduct showed negligence. In as far as not being in possession of a revolver and knowing how to use it directly he entered the Service, I think it does; but then my friend is not an isolated instance of this; indeed, the chief aim of this lecture is to point out how necessary it is for all Officers to possess and to know how to use a revolver.

After my friend got his orders he had neither time (getting his orders one evening and starting the next morning) nor facility to purchase a good revolver nor to study its construction.

Double-barrel Pistols.—The simplest form of weapon is the double-barrel pistol, and should be purchased in preference to the revolver by those who have not time or opportunity to study the construction of the latter.

Lieut.-Colonel Brabazon, 10th Royal Hussars, writing on double-barrel pistols, says:—

"I can only say that I infinitely prefer a double-barrel and breech-loading pistol carrying a heavy bullet and with a simple loading action to a revolver, I have seen so many lives jeopardized through reliance being placed in revolvers stopping a man. This a revolver seldom does. I could enumerate many cases, some of which have come under my own personal observation, and in one case where I myself was nearly being the victim of confidence placed in a revolver, when the revolver, though hitting the man aimed at, failed to stop him.

"The action of most revolvers is complicated, easily getting out of order and very difficult to keep in order. Once empty, you have not time to load them in action.

"At El Teb I nearly lost my life through my revolver jamming. I rode at a man, and my revolver (one served out to us from H.M.S. 'Jumna'—a navy revolver) would not go off.

"This is not the first time I have seen this happen to others, and once before, in Afghanistan, it happened to myself. These are my objections to a revolver and my reasons for preferring a pistol.

"1st. The revolver bullet is too light and the charge too small to stop a strong man unless you happen to hit him in a vital part.

"2nd. They easily get out of order.

"3rd. They frequently jam.

"4th. They take a long time to load.

"5th. You have to take them to pieces to clean them.

"6th. They are very difficult to make good practice with as they throw very high.

"7th. One must be in a very bad way if you want to fire more than one or two shots.

"8th. As a rule one does not reload until all the chambers are empty, and then you may not have time to do so. You are also very liable to be left under the circumstances in a position when you want at least a couple of shots while you have only one barrel loaded.

"A pistol carries a heavier bullet and efficaciously stops your man. Lieutenant Lord Airlie told me he owed his life at Abu Klea to my having given him one of my pistols with which he shot the man who wounded him; he dropped him dead.

"It is handier and comes up better than a revolver and makes much better practice. With simple breech-loading one can easily pop in a cartridge; it does not take a second. In fact, pistols are much easier cleaned and kept in order, carry a heavier bullet, really stop a man, handier to carry and to use, make better practice, and are in my opinion in every way preferable to a revolver."

Next in order of simplicity comes, I think, revolvers of the type of Colonel Colt's cavalry pistol. I purpose to describe this weapon in detail later on. It has a solid frame, and its mechanism is very simple, but, being only single-action, it has not the advantages of such weapons as our English double-action self-extracting revolvers. Weapons of this latter class are more complicated, and require more time to understand and more care to keep in working order.

Penetration and Stopping Power and Calibre.—Penetration and stopping power must not be confused with each other; the former depends principally on the striking velocity of the bullet (the striking velocity depends on the range and the quantity of powder used). Stopping power probably increases or decreases in proportion to the calibre of the bullet. It must be remembered that a bullet of small calibre travelling with great velocity is likely, not only to penetrate, but also to pass through an antagonist at short ranges, and as soon as this happens the energy yet remaining in the bullet is wasted. When the Henry-Martini is fired at 500 yards range, its effect in knocking over a weight is about the same as when fired at 20 yards range, showing the stopping power at both ranges to be about equal. Of course an express bullet has great velocity and also great stopping power; but this is due, not to the velocity in itself, but to the shape which the velocity causes the bullet to assume on striking. It is difficult to determine how the weight of the bullet, irrespective of its shape, affects its stopping power. It may be assumed that the greatest possible amount of stopping power can be attained from a revolver which has the largest calibre compatible with sufficient velocity to penetrate without passing through an antagonist.

Colonel Barrow's Opinion of the Government Revolver.—An Officer of the 19th Hussars writing from Egypt says: "As to the efficacy of the revolver, opinions are divided, but in the main strongly against it. Barrow used to get very warm on the subject, and thought the present weapon perfectly useless against Arabs, as the shock is not sufficient to stop them in their charge unless you are lucky enough to hit them in a vital spot. I remember he used to say that he would

as soon go into action with a pop-gun; and he carried (as do many others) one of those four-barrelled pistols of Wilkinson's, a much heavier weapon, the shock of which would bring down a bullock."

On the other hand, "At El Teb an Arab was cutting down one of our fellows, when a farrier shot him dead so clean that the sword just cut through the man's scalp, and that was all. It would seem from this that, if a fellow takes the trouble to practise, he can make a very useful and reliable friend of his revolver: but at the same time there is no doubt that it is susceptible of several important improvements, especially in the way of carrying a heavier bullet. I saw Besant, of the Egyptian Army, attacked by a dervish, who fired at him, grazing his arm; Besant emptied two chambers of his revolver at him, missing him, but shot him through the head with the third, killing him on the spot."

After Ulundi a Zulu showed Major Windham two wounds in his neck and shoulder that were made by an Officer's revolver at Isandlana; he said that two of his comrades had fallen dead, but, notwithstanding his wounds, he succeeded in assagaiing the Officer.

A gentleman writing from America says: "I knew many cases during my sojourn amongst the wild mining population of California where the man first shot was quite able to inflict a mortal wound on his assailant, although he subsequently died from the effects of the shot, and one case where the man so wounded killed his three opponents before he died from their bullets. These and other examples of a like nature show what an important qualification stopping power really is in a revolver. When a man is struck by the rifle bullet he has in most cases many yards to travel before he can reach the marksman; with the revolver he is close at hand."

Necessity for Accurate Aim.—Perhaps the best method of supplying this want of stopping power is to instruct the marksman so that when he fires, his shot may prove fatal. Practice makes perfect, and with a little trouble any man with ordinary eyesight can succeed in achieving this at 15 yards, a good shot at 20 or 30 yards, or even greater distances.

The stopping power depends, therefore, more on the proficiency of the marksman than on the bore of his revolver, and every one should determine for himself his stopping power range, and reserve his fire until certain of striking home. Of course the stopping power of a revolver could be increased by adding to the weight of powder and ball and increasing the calibre of the cartridge.

Relative Charges of Powder in England and America.—On this point there seems to be a difference of opinion between our own and the American authorities. With us 18 grains of powder and 265 grains of lead are considered the maximum charge admissible for the Service revolver. In America, on the other hand, they are of opinion that no inconvenience whatever attends the use of cartridges containing 37·6 grains of powder and 250 grains of lead.¹ It is possible that our authorities have been led to adopt the lighter charge more with regard to the strength of the Service pistol than on account of

¹ American Ordnance Notes, June 30th, 1876.

the recoil, the solid frame of the American pistol being more adapted to resist the shock of the exploding charge than the jointed frame used in our Service.

F. R. M., writing in the "Field," February 2nd, 1884, says: "Colt's Frontier revolver, weight 2 lbs. 8 ozs., takes 200 grains of lead propelled by 40 grains of powder. The Enfield, like most military revolvers, is 2½ lbs. in weight. Now, if an 18-grain charge is thought sufficient, it does not require a very profound reflection to arrive at the conclusion that a pistol of less than half that weight would do the work. If, on the other hand, we are to have a pistol weighing 2 lbs. 8½ ozs., let us have a 250-grain bullet and 40 grains of powder, and we shall have a weapon shooting with such force and precision that a moderately good shot, resting the barrel, never need miss a man at 200 yards. This is the style of tool with which you hear of Western frontier men killing deer at 150 yards, and it is so good that we might give it to artillerymen and take away the carbines, which would be pretty sure to be strapped up out of reach in case of sudden surprise by hostile cavalry. Of course civilians buy what pleases them, and must take the consequences if they do not make a judicious choice; but it is much more serious when those who are responsible for the national armament fall into such error, as I believe they have done in the matter of the Enfield revolver."

Recoil.—The recoil of most military revolvers is about a quarter that of the Henry-Martini, and when it is remembered what a severe kick a Henry-Martini will give if not held close, it will be seen that a considerable strain is brought on the hand and wrist by rapid revolver shooting.

VII.—*Range.*

Little need be said of the range of the revolver—perhaps the less said the better, for as far as military purposes are concerned it should rarely be employed beyond close quarters. There are cases, however, when long range shooting may prove advantageous even to an Officer, for instance, in endeavouring to capture despatches, or to disable pursuers.

It is well, therefore, that we should know what can be done in this way at a pinch. In experiments made on the Royal Military College range, it has been found that a fair pistol shot can, as a rule, with a Wilkinson revolver, place every bullet within a 6-foot square target at ranges up to 150 yards, and this target may be taken to represent a horseman. Mr. Ira Paine,¹ said to be the best revolver shot in the United States, has repeatedly put six shots running into the target of a man at 100 yards' range, and I have seen cadets make almost as good practice at a like distance.

The range of the revolver depends principally on its muzzle velocity, though the form and weight of the bullet affect it in a minor degree.

Sighting.—*Flight of Bullet affected by Recoil.*—With the rifle, the axis of the barrel at the time of firing and at the instant when the

¹ Walsh on "Revolvers."

bullet quits the muzzle are nearly coincident, but with the revolver this is not the case, owing to the recoil, acting along a line *above* the point of resistance, throwing the muzzle up. The direction of the bullet being determined by the position of the axis of the barrel at the instant it quits the muzzle, it is necessary to so arrange the sight that the proper elevation is given to the axis of the barrel, not at the moment of pulling the trigger, but at the instant when the bullet leaves the muzzle. A revolver correctly sighted to fire from a fixed rest will, when fired offhand, throw high.

In the case of a rifle the axis of the barrel produced passes above the line of sight, but in the case of a revolver, up to a range of about 270 yards, the axis of the barrel at the moment of pulling the trigger is below the line of sight, and this is because before the bullet leaves the muzzle the barrel is rotated upwards, until the axis of the barrel is sufficiently far above the line sighted for the object to be struck (Fig. 7). Of course the amount of depression to be given to the axis of the barrel depends on the length of the barrel, the charge of powder, the weight of bullet, &c., and can only be found by experiment. The angle of depression for 50 yards' range for the American cavalry revolver¹ has been carefully worked out, and is found to be $1^{\circ} 14' 24''$. This is found sufficient with the fall of the trajectory to cause the bullet to strike the object aimed at. At 150 yards, however, it will be necessary to aim about 4 feet, and at 200 yards 8 feet, above the object to be struck.

In many revolvers the *v* of the back sight, though good for fine shooting, is cut too deep for quick aiming; the rounded fore sight of most revolvers is often difficult to distinguish; many good shots therefore prefer a flat fore sight.

A very good system of sighting is to have a bright triangular piece of metal let into the pistol just below the back sight, the sharp angle of which at once catches the eye and fixes the centre of the notch.

Bright Fore Sights.—Bright fore sights on revolvers, in contradistinction to the dark ones used on rifles, are perhaps to be preferred, as they are more readily seen, and enable a more rapid sight to be taken. Colonel Silver's ivory fore sight appears to be the best.

Military Revolver sighted for 50 Yards.—In the Musketry Regulations it states that military revolvers are sighted to shoot accurately at 50 yards. The advantage of this seems to be very questionable; putting aside the fact that the revolver is used nine times out of ten at close quarters, the tendency of all marksmen, especially when hurried, is to take rather a fuller than a fine sight. It is probably on account of this 50 yards sighting that marksmen find that their bullets generally strike high.

A good revolver shot will often discover, on purchasing a new revolver, that his shots go high or low, to the right or to the left; this is owing to the position of the fore sight, and can be easily remedied by having the fore sight raised, lowered, or inclined to the right or left.²

¹ "United States War Office Report on Revolvers," 1884.

² Major McClintock on revolvers, "Royal Artillery Journal."

Revolvers are not fitted with movable back sights; therefore, in long-range shooting, allowance must be made for the fall of the bullet by aiming well over the object to be hit.

Some revolvers are made with the fore sight attached by means of a screw, and by removing this screw and substituting a different fore sight a point-blank aim may be taken, but this expedient does not recommend itself as practical from a military point of view.

Cleaning.—It may almost be said that to be able to clean a revolver is as important as to be able to load it, for certain it is that unless properly cleaned it will sooner or later either jam or get out of order in some other way.

The arrangements in all first-class revolvers for cleaning are by no means complicated; they, however, require some study, but with a few lessons and some practice they may be easily mastered. The chief point to be learnt is to take the weapon to pieces and put it together again.

In the Musketry Regulations of most Continental armies, more particularly the French, very complete instructions are given for taking the revolver to pieces, cleaning it, and putting it together again. These necessary instructions appear to be wholly omitted from our Musketry Regulations.

Leading.—Leading occurs in the barrels of revolvers from the manner in which they are rifled. Deep sharp grooves are likely to lead. A leaded barrel may be cleaned with mercury.

Facilities for cleaning English Revolvers.—Before quitting the subject of cleaning, attention must be drawn to the advantages possessed by most of our English revolvers over many of American make. In the former no screws or separate fastening pins are employed; to remove the cylinder for cleaning, all that has to be done is to open the revolver and press a thumb-piece. In many of the latter a small screw has to be taken out, which is very liable to be lost, and to remove which a turnscrew or knife is required.

VIII.—*Safety to the Firer and his Friends.*

First, with regard to safety to the firer, a fertile source of danger is the liability that self-extracting revolvers have of going off without being properly closed.

Captain Burn-Murdock's revolver went off in this manner during the Nile Campaign, wounding him slightly in the face, and rendering the weapon unserviceable. He was fortunately able to borrow a second revolver, which served him in good stead at Abu Klea.

Reliable Quality of Materials important to Safety.—Again, the liability to accident will depend greatly on the quality of the materials of which the revolver is constructed, and the care with which they have been put together.

A revolver should not be offered for sale by a first-rate gun-maker until it has been thoroughly tested as to material and workmanship.

Some marksmen, to steady the weapon, raise the left arm and rest

the barrel of the revolver upon it. This plan cannot be adopted without risk, owing to the escape of gas between the cylinder and the barrel, which will sometimes burn the coat and arm.

A marksman must be careful with a strange revolver to see that it does not go off when at full cock before he pulls the trigger; a day or two ago there was a case of a revolver which could be discharged from full cock by a slight shake of the wrist.

Manner of carrying the Revolver.—Secondly, with regard to the safety of comrades. Their safety depends not so much on the revolver, as the manner in which it is carried and held. The safest way to carry a revolver, as far as the bearer is concerned, is in a belt at the back; it is more quickly drawn when thus carried, and this is the plan generally adopted in the United States. The revolver may also be carried on the hip. The belt which holds the revolver case should be fitted with leather cartridge carriers. A small purse on the inside is also convenient for money or other valuables. On service a lanyard should be attached to the handle of the revolver and then passed round the neck, so that if the revolver be dropped it can be easily recovered; this is very important in the case of mounted men. On horseback the safest and most convenient manner of carrying the revolver is no doubt the holster pipe; still this is not to be recommended. The chances of a rider and his horse parting company, either by accident or design, have to be taken into account, and, as the separation might take place at a critical moment, the balance of opinion is in favour of the revolver being part of the man's equipment rather than that of his horse.

Mr. Stanley in his African wanderings fitted a rough stock to his revolver, and carried it suspended from his shoulder between his arm and his side. He found this method very convenient for rapid use, the fact of the stock being pressed to the shoulder when firing considerably assisting the aim. General the Hon. W. Feilding has also borne testimony to the advantage of this plan.¹

Chief Causes of Accidents.—Revolver accidents chiefly happen when the weapon is held in the hand preparatory to use. It was thus that Colonel Gonne, 17th Lancers, and Colonel the Hon. C. H. Lindsay, St. George's Rifle Volunteers, were both accidentally wounded, curiously enough, both in the same place, the thigh, while superintending the practice of their corps. In nine cases out of ten these accidents are due to want of knowledge of the mechanism of the weapon, and therefore a hard and fast rule should be laid down that no loaded revolver should be handled until its construction and action are thoroughly understood.

Writing on this subject from Egypt, Colonel Murray says: "If the man is not accustomed to handling a revolver it is a most dangerous weapon, and in a *mêlée*, if a man gets excited, he may just as easily shoot a friend as an enemy."

Again, Colonel the Hon. P. Methuen writes: "I consider the revolver most dangerous for anyone but the enemy. In my short Cape experience one bullet went through an Officer's tent, over the

¹ Fielding on "The best Outfit for Exploration," 1885.

Quartermaster's head, and eventually attracted attention in an adjoining camp. This was from indifferent handling during cleaning. A man had a bullet lodged in his leg at the range of one yard; this was from a man showing off the admirable mechanism of his revolver, not knowing it was loaded. A similar accident happened on board ship going out to the Cape.

"Another time Colonel Cotton told me of an Officer who went through the pistol practice necessary for shooting your opponent through the head in a duel. I suppose the pistol went off rather after its time, for the bullet went through the deck, and nearly did for the First Lieutenant in his cabin.

"These are all instances of accidents occurring from gross ignorance, and I for one feel uncomfortable when my friends for the first time on board ship ask for target practice with their new revolvers, 'just to see what they are like.'"

The Colonel of a Highland regiment on passage out to Egypt in 1882 was heard to remark: "What I funk is not the Egyptians, but the subalterns' pistols."

The only means of getting a man to be steady in using his revolver is to make him a thoroughly good shot with it up to at least 30 yards, and then, when he has confidence in his weapon, he will not fire at random, but will take care he shoots the man he intends to, and no one else. With a man not accustomed to a revolver, the very knowledge that he has six barrels, or rather shots, to fire off tends to make him unsteady, as he thinks, if he misses with the first, he is sure to hit with one of the others, so that it does not much matter about aim. A steady pistol shot, on the contrary, makes sure of each shot, perhaps from mere habit.

A great source of danger, both to the firer and bystanders, is the difference in pull-off in the same revolver when fired continuously or in single practice. I have myself on two or three occasions seen a revolver go off accidentally from this reason. The most careful shot is liable at times to forget the difference between the pull-off of the continuous and that of the single shot. The only way to guard against accidents of this sort is to insist on the revolver being always held (except while taking aim) with the muzzle pointing downwards. On some ranges a mechanical contrivance, Fig. 4, is employed, which ensures the revolver being kept in this position.

Safety Stops.—There is a simple arrangement to be found in the revolvers of the Royal Irish Constabulary and others, which enables the weapon to be rendered perfectly safe for portage. It is a small thumb-piece attached to the base of the hammer, which, on being turned, locks its action. The objection to this catch or stop appears to be that the marksman is liable to forget that it has been applied, and on attempting to fire without releasing it finds to his surprise, and may be horror, that his revolver will not go off.

Colt's revolvers have a safety notch, on which the hammer rests before it comes to the half cock, and the pistol should always be carried with the hammer resting on this notch.

Rebounding Lock.—English revolvers are now generally made with

a rebounding lock. This is a great improvement, as it renders the revolver far safer for portage. Lieutenant Clementson, 19th Hussars, writing last month from the Soudan, says: "Revolvers have an uncomfortable knack of going off at the wrong time and in the wrong direction. Last week, when out with a patrol, my interpreter's revolver, which he was carrying strapped to his saddle, suddenly went off, and killed the camel he was riding, the bullet passing through its spine. This was unaccountable enough, as it was certainly not cocked, and was so placed that he could not have touched it with his foot or anything of that sort."

IX.—*Danger Precautions.*

Danger precautions may be considered under two heads: 1st, the precautions to be taken to guard against accidents in instruction drill and practice; 2nd, those precautions it will be necessary to take when the weapon is being used on active service.

The only way to guard against accidents of the 1st class is to insist upon the strict observance of carefully drawn-up rules.

With beginners it is well that the revolver should be loaded for them by the instructor, who places it in a stand ready for use.

Revolver Stand.—No revolver range should be without this stand; it is made by driving a post firmly into the ground, and then nailing upon it a board, about one foot square, previously prepared with one or more holes to fit the barrels of the revolvers. Its object is to insure the revolver being always pointed towards the ground when not aimed at the target (Fig. 4). The firer, on his name being called, should advance from the barrier and place his hand on the revolver, previously loaded and placed in the stand by the instructor; he should then, at single practice, cock the revolver, while still in the stand, before raising it; if at continuous practice, he should raise it at once and carry the muzzle direct from the stand to the target. As soon as he has pressed the trigger, at either practice, he should lower his hand until the muzzle of the revolver drops into its place in the stand, he should then, without necessarily relinquishing his hold of the weapon, watch his shot being signalled.

Shooting at the running man, the same course should be adopted, with the exception that the muzzle of the revolver need not be placed in the stand after each discharge, but be held pointing at the target until the six shots are fired or the running man disappears.

Barrier necessary on Range.—Across the end of the range, about five yards in rear of the firing-point, there should be a barrier beyond which no one should be allowed to pass except the firer, the instructor, and the superintending Officer.

Safety to the Public.—The safety of a range will depend very much on where it is situated. In most cases the ordinary precautions adopted on a rifle range are sufficient. Where space is an object, as in a town or close to barracks, safety to the public can be secured by the following system (Fig. 5).

The firing-point being fixed as the centre of a circle, the back

screen or butt and the intercepting screens are all described as arcs of circles struck from the common centre, the object of this being that all bullets aimed from that common centre and impinging on any part of the surfaces of either of those screens must necessarily strike at right angles, so preventing the possibility of the bullet glancing away from the spot struck; and, as the screens would be made of iron plates faced with wood there could not be any back splash. Again, presuming that it be desirable to have an 18 feet opening clear from the firing-point to the target, the screens A, A, each having a surface of 10 feet, are so placed as to intercept the flight of a bullet aimed at a point immediately beyond the limit of protection afforded by the butts.

In like manner the screens B, B intercept the bullet as soon as its line of flight passes outside the limit of protection afforded by A, A, and in the same manner with C, C, so that the fixing of three screens on either side gives absolute protection for an entire half-circle described from the common centre or firing-point.¹

X.—*Precautions against Accidents in the Field.*

With regard to precautions which should be taken to guard against accidents in the field, they would appear to be as follows:—

1st. No one should carry a revolver until he is thoroughly acquainted with the method of taking it to pieces, loading and firing it. This ought to apply even more strongly to men than to Officers. But what is our present practice? Drivers of artillery and commissariat are supplied with revolvers on proceeding on active service, no time is then available for training them in its use, and they proceed on service with weapons more dangerous to themselves, their comrades, and their cattle than to their enemies. If fortunate enough to return to England, instead of being allowed time and opportunity to learn the construction and use of their arms, their revolvers are at once given into store. Imagine, gentlemen, a cavalry regiment on home service without sabres, an infantry regiment without rifles, and you will have the position of our drivers of to-day.

Lastly, it should be impressed in the strongest possible way upon all Officers employed directly with troops that the revolver is not intended for *offence*, but only for *defence*, and that of the most pressing nature, and that therefore the revolver should remain in its case except at moments of passing emergency.

Targets.—There are several sorts of targets used for revolver shooting. In Belgium, where they practise constantly, they use lead targets, which travel backwards and forwards on a pair of rails between the butt and the firing-point, thus obviating the necessity for a marker. Paper and cardboard targets are often used. Iron figure targets are, perhaps, the best; they may be painted similar to a third-class Wimbledon target. This arrangement makes the head count only two, which, compared with the five awarded to the bull's-eye, is con-

¹ "Naval and Military Magazine," Oct., 1885.

sidered hard by some, but is not so in point of fact, as the head is as far from the centre aimed at as the knees. Without altering the scoring rings, the target may be painted some natural colour, to represent a man, and this plan is much to be recommended.

The Marker's Butt.—The marker's butt should be about 2 feet from the target, with a stout palisading and plate-glass window, to protect the marker from the splash of the bullet. Holes should be cut in this palisading below the plate-glass window, through which the handles of the discs pass. The discs themselves rest in a hollow in front of the target; the parts of the handles outside the palisading should be hidden from view by a small ramp. Brushes are attached to the reverse sides of the discs to enable the marker to re-colour the target while showing the position of the shots. The advantages of this system are rapidity, as the discs have only a very short distance to travel, and safety to the marker from splash; this latter point is of importance, as many markers have been injured by the splash of the bullet passing through the usual marking slit, on rifle as well as on revolver ranges (Figs. 8, 9).

Running Man.—Besides the ordinary practice at a stationary target, when plenty of time for aiming is taken, it is important that Officers should practise rapidity of fire, and this can be best done by firing at a moving target.

Most moving targets run from right to left, and *vice versâ*. This sort of target does not appear to be at all suitable for revolver practice. An Officer should never employ his revolver on an enemy passing across his front, but on an enemy advancing towards him.

The following is a description of the target used on the R.M.C. range (Fig. 9). By means of a rope, three pulleys, a wheel, and a trolley an iron figure target is made to travel up and down the range. To obviate the possibility of the firer taking a pot shot, either before the target begins to move or after it has stopped, the figure is not fixed rigidly to the trolley, but is swung on its centre with the weight so adjusted that, while its normal position is vertical, a slight blow will turn it over. About two yards from the pulleys, nearest the marker's butt, two posts are driven firmly in the ground; on either side of the tramway these posts are connected by an iron bar, sufficiently raised from the ground to allow the fulcrum on which the target swings to pass beneath (Fig. 11). Another post is fixed one yard from the ends of the tramway, nearest the firing-point, with an arm sufficiently long to reach the upper portion of the target.

The manner of working this "running man" target is as follows: It is first run under the bar, which, by forcing the figure into a horizontal position, prevents its being seen from the firing-point. On the word being given to "run up," the marker turns the handle, and as soon as the head of the figure clears the bar it assumes a vertical position. The figure remains vertical until it comes in contact with the fixed arm at the end of the run (A, Fig. 9), when it again swings over into the horizontal position. The reasons for the target starting two yards in front of the pulley is, in the first place, to protect the

marker from splash; in the second, to allow the figure on being drawn up to the pulley to again become upright, so that the shots can be signalled by the marker.

Ammunition.—There are three descriptions of Government ammunition :—

Mark I.—Calibre 0·450; it contains 13 grs. of powder and 225 grs. of lead: it is now used principally in the Navy and on foreign stations.

Mark II.—Calibre 0·455; contains 18 grs. of powder and 265 grs. of lead: this seems to have been an intermediate experimental cartridge.

Mark III.—Calibre 0·476; contains 18 grs. of powder and 265 grs. of lead, and is the present Service cartridge (Fig. 6).

It is difficult to understand why the calibre of the bullet should have been altered from 0·455 to 0·476, the bore of the barrel remaining the same, the striking calibre of the bullet is as before, but a far greater strain is brought on the revolver, as the bullet, before it can pass through the barrel, has to lose 0·026 of its calibre.

Revolvers chambered to take Mark I are useless for Marks II and III, those chambered to take Mark II will take Mark I, but not Mark III. Revolvers chambered to take Mark III will take all three cartridges, but if opened to extract will throw out the live as well as empty cartridges of Marks I and II.

Cartridges should not be allowed to get too old; it is also very important that the exact number of grains of powder for which the pistol is sighted be employed; a few grains more or less making the bullet strike considerably higher or lower than the point aimed at.

An Officer writes from the Soudan: “ I don’t think the Service charge sufficient or the bullet heavy enough. The Government ammunition is not made carefully, and I have found some of their cartridges difficult to load, although I have the proper-sized revolvers to take them.”

The ammunition supplied with the Colt revolver contains 40 grs. of powder and 250 grs. of lead, the recoil not being much in excess of that of the Enfield; the Enfield being the heavier weapon.

In the “ Field ” of October 18th, 1884, Major McClintock, R.A., Assistant-Superintendent, Royal Small Arms Factory, Enfield, says :—

“ It may be supposed that, owing to its large charge, the recoil of the Colt’s Frontier revolver is excessive, but this is not so. As a matter of fact, and as shown in the recoil column in the table, the recoil of this pistol is little more than that of revolvers firing the Government 0·455 cartridge: and on account of the balance of the Frontier pistol even this slight excess of recoil is not felt.”

Buckshot cartridges have been recommended; no doubt at a distance they would wound many, and at close quarters prove a terrible shock. At night they would be invaluable. Express bullets have also been suggested for use with revolvers. If the powder charge were sufficient to cause them to spread, they no doubt would have great stopping power.

Increased stopping power may be given to a revolver bullet by cutting off the pointed end with a penknife. A bullet treated in this way will penetrate an iron plate on which a conical pointed bullet would flatten.

Experiments have been made which tend to prove that greater accuracy, velocity, penetration, and less recoil, can be obtained with the Service ammunition by using a larger calibre for the barrel than the 0.450 of the Service weapon. Fig. 13 is an exaggerated section of the chamber cylinder and barrel of an Enfield.

The bullet is made in the form of a hollow cylinder, this hollow being partially filled with a clay plug A (Fig. 6); a hollow B is left between this plug and the nose of the bullet.

The cannellures at C, D, E, weaken the bullet considerably.

During some recent experiments with Mr. Wilkinson's ammunition, which is supposed to be the same as the Government, it was found that the bullet on quitting the muzzle of the revolver frequently broke into two fragments at one or other of the cannellures.

This breaking up of the bullet was only discovered towards the conclusion of some long trials of several revolvers and pistols, and, of course, when found out, completely invalidated the trials.

A few rounds of Government ammunition have been obtained and fired without any sign of breaking up, but time has not allowed of an exhaustive test.

XI.—*The Enfield or Government Revolver.*

This revolver weighs 2 lbs. 8 ozs., has a barrel 6 inches long, and carries the Government cartridge, 0.476.

It possesses the following advantages :—

1st. It shoots with great accuracy, owing to its careful manufacture.
2nd. The cylinder axis, being rigid, serves to strengthen the pistol and prevent the possibility of the cylinder blowing upwards.

3rd. The extractor requires no spring.

The defects of the pistol appear to be :—

1st. A difficulty of extracting the cartridges; owing to the rigid cylinder axis, they frequently jam at the base of the pistol.

2nd. The time taken to load. This is quite as long as that taken with the solid frame Colt or Silver.

3rd. The weak joint action. This is to be strengthened in future pistols of the same make.

It has been said that this pistol combines most of the disadvantages of the jointed frame without the advantages of the solid frame system.

Thomas's Patent.—This is a very strong form of self-extracting revolver; the manner in which the cartridges are extracted is very similar to that employed in the Enfield. This revolver has a solid frame; it is tedious to load.

Cogswell and Harrison's Colonial Revolver.—This is a solid frame strong revolver, very like a double-action Colt; it has, however, a smoother pull-off, and a very good arrangement for removing the cylinder.

Mr. Harris, writing to the "Field" upon Messrs. Cogswell and Harrison's Colonial pistol, says:—

"I beg to submit the following particulars of its performance when I was shooting with it this day:—

"Six shots at a card target 12 inches by 10 inches, at fifty paces. Colt's long 0.45 cartridges used. Every shot well within target; greatest distance from centre of card, $3\frac{1}{4}$ inches.

"Six shots at card 10 inches square, 2-inch bull at thirty paces, 0.455 cartridges, one shot in bull, two within $\frac{1}{2}$ -inch of same, rest at $1\frac{1}{2}$ inches, 3 inches, and 4 inches respectively from bull.

"Six shots at card 6 inches square, at twenty paces, Winchester, 0.44 cartridges used. One shot missed target, all others well within square.

"This Winchester ammunition can be used in this pistol in case of emergency, as, although the bullet is a little smaller than the barrel, still it shoots very hard and tolerably straight, as this result shows. With an all-round pistol like this, ammunition can be got for it in any part of the globe. Sixty additional shots were fired, the last being as accurate as the first, and no trace of leading in the barrel. The recoil from the long 0.45 Colt cartridges was by no means too heavy; using both hands to hold the stock insures a steady aim and splendid shooting with this ammunition."

Webley's W.G. Revolver, 1886.—This revolver has a barrel 6 inches, weighs 2 lbs. 8 ozs., and carries the Government ammunition as well as the 0.450. The chief advantages claimed for this pistol are—

1st. That, owing to its large circular hinge and massive breech-fastening, it is practically as strong as a solid framed revolver, and will stand as heavy a charge.

2nd. That by a simple arrangement of two collars fitting into each other, it is impossible for any fouling to reach the spindle on which the cylinder rotates.

3rd. That rapid sighting is obtained by the wide shaped V of the back sight.

4th. That by an ingenious contrivance of the lock the hammer is raised for continuous practice by about half the pull, the other half being thus rendered so light that as good shooting can be made at continuous as at single practice.

5th. That it is impossible to discharge the weapon until properly closed.

The objections to the weapon appear to be—

1st. That it is more complicated than a single-action non-extracting revolver.

2nd. That, with the view of enabling the revolver to fire both the 0.450 and the 0.476 cartridge, the barrel has been bored too small to obtain the best results from the larger cartridge. Of course a purchaser could always have the barrel of his revolver bored to suit the larger-sized ammunition.

3rd. The arrangement for locking the cylinder does not appear to be quite as substantial as might be wished.

*Kynock's Revolver.*¹—The chief peculiarity in this revolver is the manner in which the hammer is raised. This is accomplished by the second finger acting on a second trigger. The advantages of the pistol are—

1st. Its combination of single and double action, which insures great accuracy with rapid firing.

2nd. That the hammer is covered in.

3rd. Its cheapness.

The disadvantages appear to be—

1st. As the weapon can only be kept cocked by a continuous pressure of the second finger, it will not admit of very accurate practice being made with it when time is no object.

2nd. The top-fastening does not appear to be quite solid enough.

Silver.—The "Expert."—This clever invention has been designed with the view of combining the advantages of solid frame revolvers with those of quick extraction; it weighs 2 lbs. 8 ozs., has a length of barrel 6 inches. The advantages claimed for the pistol are:—1st. Its rapid extraction. 2nd. Its solid frame. 3rd. Its light weight. 4th. Its ivory fore sight.

The objections to it appear to be—

1st. That, though it extracts rapidly, it takes longer to load than a jointed framed revolver.

2nd. That the extracting apparatus is more exposed to injury than is the case with the self-extracting revolver.

Wilkinson's Revolver.—This revolver weighs 2 lbs. 8 ozs., has a length of barrel 6 inches, and it is a jointed self-extracting revolver of considerable merit. The advantages claimed for it are:

1st. Its accurate shooting with Government ammunition; this is attained by having the calibres of the chamber, the cylinder, and the barrel suited to 0.476 ammunition, which is not the case with many revolvers.

2nd. It has a very secure form of fastening with a patent safety arrangement, which prevents the possibility of the revolver being fired until firmly closed.

Its disadvantages appear to be:—1st. That, though fully able to withstand the shock of the present Government charge, it is doubtful whether either the top fastening or lower joint would stand the 40-gr. powder charge carried safely by the Webley W.G. 2nd. The ratchet has a tendency to wear.

Wilkinson's revolvers have been subjected to a two years' trial at the Royal Military College, during which time over 30,000 rounds have been fired, and with the exception of an occasional accident to the ratchet they have stood the severe tests put upon them perfectly. The results of this long trial conclusively prove that, provided due precautions are taken, 1st in purchasing, 2nd in keeping in order and

¹ Since this lecture was written, Mr. Kynock has further greatly improved his revolver. This improvement consists in a simple arrangement at the back of the trigger guard which catches the cocking trigger and holds the hammer at full cock until the firing trigger is pressed, thus enabling the pistol to be used at single and continuous practice.

cleaning, self-extracting revolvers may be as thoroughly depended upon as solid frame revolvers.

To show what may be done with this revolver when fired rapidly with trigger action by a good shot, I have here a target 1 foot square on which are forty-eight hits, only ten of which are outside a 6-inch centre. The range fired at was 20 yards, the time taken 4 minutes 52 seconds, number of rounds fired forty-eight.

Colt's Revolver.—Colt's United States Cavalry Revolver. This revolver weighs 2 lbs. 5 $\frac{3}{4}$ ozs., it has a barrel 7 $\frac{1}{2}$ inches long, it is single-action, calibre 0.45 inch.

Its chief advantages appear to be its solid frame, its simplicity of construction, and its accuracy of fire at long ranges. It not only takes its own ammunition of 40 grs. of powder and 250 grs. of lead, but it will also take the three Marks of our Government cartridge.

When its own ammunition is used with it, its penetration is double that of the Service revolver. The defects of the weapon are, first, its length, 12 $\frac{1}{2}$ inches, which renders it unsuitable for close fighting; second, it is single-action; third, it is non-extracting.

It compares favourably with the Government and other revolvers in point of weight, being 2 $\frac{1}{4}$ ozs. lighter than the Enfield.

Lancaster's.—Lancaster's pistols are made with either two or four barrels; they possess the following advantages over the revolver:—

Having no projecting parts, they are easier carried; having no hammer, they are safer; they ought to shoot truer than the revolver, owing to there being no escape of gas between the cylinder and the barrel; for the same reason they may be supported on the left arm when firing, which cannot be done with safety with a revolver; they cannot jam; and, lastly, the mechanism, being well protected, is little, if at all, affected by sand, wet, or dirt. These pistols were carried in the Soudan by Officers of the Royal Irish and others who speak very highly of them. The following letter from Lieutenant Whitla, Queen's Bays, is interesting:—

“On reaching my station in India (Umballa), a Gladstone bag belonging to me, containing amongst other things a Lancaster pistol, was stolen from my baggage, and I could not find any trace of the things stolen until *three weeks* afterwards, when a heavy shower of rain washed away part of a mud wall forming the boundary of the riding-school, and the men who were told off to replace it found my pistol buried there. The barrels were, of course, rather rusted, but the lock revolved as freely as ever, and the rust had not penetrated to it at all; in fact, I fired several rounds from it after the *barrels* had been cleared from the rust. I should add that the pistol was found buried without any sort of covering on it. The stock was also slightly eaten by white ants.”

These pistols are rather expensive, costing about 8*l.* They are made to carry the Government ammunition, 0.476.

With a view of comparing some of the different types of pistols, Captain B. Barter, the Lincolnshire Regiment, one of the best revolver shots in the Army, and Mr. Kelly, R E., have kindly carried out a series of independent experiments.

Cogswell and Harrison, 0·476 bore, Colt Action.—Very full sight required, which for rapid firing is an advantage, as most revolvers throw high; when in a hurry the firer is apt to take a full sight, in such cases this revolver would therefore carry point blank. Too full a sight, however, is required for very accurate shooting.

Enfield Service Revolver.—The pull-off is good, the weapon appears to me inaccurate and clumsy.

Wilkinson.—A splendid weapon, with very good sighting and pull-off action, rapid and very easy to load.

Sighting, point blank with fine sight. On the whole the most accurate and satisfactory revolver I have tried.

Colt's Frontier.—Too long in the barrel. Trigger too narrow, and stock short and uncomfortable; only one action, and that clumsy.

Kynock's.—I do not like the action of this revolver. There might be a chance of a piece of the flesh between thumb and forefinger being caught and nipped. I found this revolver apt to miss fire.

Lancaster's 4-barrel Pistol.—Has only one action—continuous, very hard pull-off. The sighting of this pistol is very serviceable.

Lancaster's 2-barrel Pistol, Bore 0·577.—Continuous action, only very hard pull-off, and a very heavy weapon. The kick is very great.

Webley.—Very good action, pull-off too light (when cocked) for service. In continuous practice the pull-off is just right. The revolver I fired with carried slightly to the left.

Silver, 0·450 Bore.—The safety action is useful (unless it be liable to get out of order). The sight has a white bead which removes the liability of losing the sight altogether by mistaking the metal of the breech for the fore sight, as sometimes happens when both are shiny. Very handy to unload, and action appears simple and not liable to get out of order.

Colt's Double Action.—Good pull-off. Carries very high.

Of all the revolvers I tried, I liked Wilkinson's much the best, combining a good serviceable pull-off both when cocked and in continuous practice. With great accuracy and good balance, it is also the easiest to load.

Next to it I like Webley's and Silver's best, the former on account of the good pull-off in the continuous practice, and Silver's on account of the (white bead) sighting, and of the simple way it ejects the empty cartridges.

Experiments in Rapid Firing by Lieut. Kelly, R.E.—Twelve shots fired with each revolver, time taken over the following operations:—Firing six shots, unloading, reloading, firing another six shots and unloading.

Target was circular, 2 feet diameter. Range, 30 yards; firing as quickly as possible consistent with any aim, almost snap shooting.

| Pattern of revolver. | Time. | Hits. Max. 12. | Remarks. |
|---------------------------------------|-------|----------------------|--|
| | m. s. | | |
| No. 1. Wilkinson .. | 0 40 | 10 | Fairly easy pull ; a severe recoil, apt to hurt the hand by striking between thumb and forefinger ; appears to throw about 5 inches left and 15 inches high, with full sight. |
| No. 2. Kynock..... | 1 3 | 11 | Sight of this is too thin and hard to see ; the 0.476 ammunition fits very tight, and makes it apt to jam ; it spurts back behind ; throws 10 inches high ; correct direction. I consider the double trigger arrangement the best of all ; it is not liable to unsteady the hand, because the stiff pull is constant and steady, and when the aim is taken a light pullfires. I found this the pleasantest weapon of all for quick-firing. |
| No. 3. Enfield | 1 25 | 6 | The loading arrangement is very slow ; the unloading is clumsy ; cartridges not completely ejected ; the trigger is a long way from the hand, so that only the end of the finger can reach it ; it jammed slightly once ; throws 12 inches left and 24 inches high. |
| No. 4. Webley..... | 1 30 | 8 | 4 missfires in 12 shots ; throws 7 inches high ; correct line. |
| No. 5. Colt, single action. | 2 5 | 9 | Appears to throw excessively high—3 feet at least ; rather violent recoil. A single-action revolver is not up to modern requirements. |
| No. 6. Colt, continuous action. | 1 40 | 7 | Very stiff pull ; violent recoil ; throws 12 inches left, 20 inches high about ; the butt is too small for the hand. |
| No. 7. Cogswell and Harrison. | 1 45 | 11 | Easy pull of trigger ; clumsy unloading arrangement ; throws in correct line of elevation. |
| No. 8. Silver | 1 25 | 9 | Has a very good fore sight, an ivory circle ; an easy pull ; but requires special ammunition. |
| No. 9. Lancaster 2-barrelled pistol. | 1 30 | 3 | Very stiff pull ; most violent recoil, which hurts and unsteadies the hand. |
| No. 10. Lancaster 4-barrelled pistol. | 1 10 | 7 | Same as No. 9. |

The above does not represent good shooting, as no doubt every shot should hit the target, but I consider that it shows the comparative

values of the revolvers for rapid firing, such as most likely to be required in the field. It is conclusively in favour of those with a light pull, or as in the case of Kynock's, of a stiff pull constant and steady, and a light pull when required to fire. Kynock's trigger and Silver's sight appears a good combination.

America:

The Americans depend very much on the revolver in war. They maintain that it is *the* cavalry weapon *par excellence*. General Lee, writing on this subject, says: "The sword has lost much of its effectiveness by the improved revolver, with which the cavalry man will make the dashing charge with more confidence. My experience was that the cavalry man was timid with his sabre in fighting against the revolver, and for the least excuse will drop the sabre for the revolver. . . . In every instance under my observation the moral effect of the revolver was greater than that of the sabre, the momentum with good cavalry is as readily obtained with the revolver as with the sabre. The revolver is the all-important weapon with the cavalry man in motion, and is indispensable in his equipment."

The revolvers used are Colt's and Smith and Wesson's; the former are, however, superseding the latter. The United States War Office purchase about 1,500 revolvers annually, and since 1879 these have all been of the Colt type.

The Americans do not appear to attach very great importance to the employment of heavy powder charges.

Notwithstanding the fact that the Colt will carry with ease 37·6 grains of powder and 250 grains of lead, the War Office cartridge contains only 28 grains of powder and 230 grains of lead. This is probably due to the Smith and Wesson (a jointed revolver) not being able to stand a heavier charge without injury, and the War Office very naturally are loth to introduce two descriptions of Service ammunition. Still it is six years since the War Office purchased any jointed framed revolvers, and if our go-ahead cousins had considered a heavy charge of much importance they would before this have cast their Smith and Wesson's and adopted the heavy Colt cartridge.

As many Officers and others are at present armed with Colt's revolver, it has been thought advisable to give the following quotations with reference to their mechanical features and manipulation taken from the American Arms Regulations, 1882:—

"Mechanical Features of the Colt.—The frame is made of wrought iron and case-hardened. It encloses the cylinder and is made in one piece, into which the barrel is screwed. The centre-pin bushing affords a third surface of revolution for the cylinder, and diminishes the chances of sticking from dirt or rust. The cylinder and bushing may both revolve on the centre-pin, which in turn may revolve in its own bearings. The double feed-finger on the hand gives two points of contact with the ratchet instead of only one. The finger of the hand moves in the direction of the tangent to the circle upon which the ratchet is cut, and, after rotating the cylinder to a certain position, it passes from the notch of the ratchet, and can no longer act upon it. But, before the first or upper finger leaves its notch in the ratchet, the lower finger begins to act upon the next notch, and thus insures the certainty of the revolution of the cylinder. This form and action of the hand

allows the space between the chambers to be utilized for cutting the ratchet-teeth upon a larger circle, thereby increasing the leverage, and consequently the rotatory effect of the hand upon the cylinder. It also produces less wear upon the ratchet. The hammer has three notches, the safety notch, the half and full-cock notches. The former is the first one *felt* in cocking the revolver.

"Manipulation.—To load the Revolver.—Hold the revolver in the left hand, muzzle downward. Half-cock it with the right hand, and open the gate. Insert the cartridges with the right hand, close the gate, and bring the hammer to the safety notch. Keep it there until the revolver is to be fired.

"To eject the Cartridge-shells.—Hold the revolver in the left hand. Bring the hammer to half-cock, and open the gate. Push out the shells with the ejector-rod, using the right hand, turning the cylinder with the thumb and forefinger of the left hand.

"To dismount the Revolver.—Half-cock the revolver; loosen the centre-pin catch-screw; draw out the centre pin; open the gate, and then take out the cylinder. To remove the ejector, turn out the ejector-tube screw, then push the front end away from the barrel and pull it toward the muzzle.

"The stock can be removed by turning out the two back-strap screws just behind the hammer, and that at the bottom of the strap. Remove the mainspring and guard. The parts of the cock can then be readily separated. The centre-pin bushing should be pushed out for cleaning. To remove the gate, turn out the gate-screw in the lower side of the frame; hidden by the guard. Withdraw the gate-spring and catch, then push out the gate.

"To assemble the Revolver.—Follow the directions for dismounting the revolver in inverse order. The mainspring is most conveniently mounted by turning in the screw part way, and then swinging the front end of the mainspring around it until it bears against the under side of the hammer-roll. The centre-pin bushing should be frequently removed for cleaning."

Russia.

The Russians have adopted an American revolver, Smith and Wesson's, 6 chambers and double action. Cal., 0.42 inch; length of barrel, 6.6 inches; weight, 2 lbs. 7 ozs. It carries a cartridge containing 23 grains of powder, 233.7 grains of lead. In the cavalry, all ranks except privates of transport are armed with it, and, like the American, but contrary to our own and other Continental armies, they are trained to depend to a considerable extent upon it. In the artillery all ranks except privates of transport are also armed with the revolver.

In the infantry, all Officers, sergeant-majors, drummers, buglers, non-commissioned officers of transport, and clerks are armed with it. Regular annual practice is carried out by both Officers and men at a target representing a man standing at 25 paces.

All senior classes at military educational establishments pass through an annual course.

To give some idea of the number of revolvers carried by Russian troops, it may be mentioned that 100,000 Smith and Wesson's have recently been supplied on a single contract, and this is not more than half the number that they possess.

Perhaps, in considering the introduction of the revolver into the Russian Army, more especially into the cavalry arm, it would be as well to mention two examples, taken from Colonel Dennison's book, showing the results of two engagements, in one of which the revolver was used, in the other the sword, as it is chiefly on this book that

the Russians have introduced revolvers, and from these examples we may gather the use they expect to make of them in the future.

"A fight took place in Virginia in November, 1864, between a squadron of Mosby's Confederate partisan cavalry, under Major Richards, and a squadron of Federal cavalry, under Captain Blazer. After a sharp hand-to-hand fight, in which the Confederates used the revolver solely, the Federal squadron was completely defeated; the casualties were, on the Southern side, only one man killed and several wounded, but so deadly was the effect of the revolver that Blazer's loss was 24 men killed, 12 wounded, and 62 prisoners. This was in killed and wounded 36 out of 100—more than one-third, while killed, wounded, and prisoners comprised virtually the whole force. The proportion of the killed to the wounded is an extraordinary proof of the deadly effect of the revolver.

"Compare this with the fight at Egmont-op-Zee, on the 2nd October, 1799, between the English dragoons and some French cavalry, where two troops dashed into 500 victorious French horse, and after a *mêlée* drove them off.

"Then the 500 French returned, and met at the charge the English, reinforced by one troop; a second fight then ensued, and yet in both conflicts, the sword being used on both sides, only three English troopers were killed, and nine wounded. In a fight of the same kind with revolvers, how different would have been the losses!"

Again, a troop sergeant-major of the 10th Hussars says:—

"On charging the Soudanese at El Teb, I first attempted to cut them down with my sword, but found I could do little execution with it; the enemy for the most part eluding my blows, and even, when struck, appearing to suffer little from them; I then drew my revolver, and soon knocked over three or four."

It has often been said that that Army which first learns how to take the best advantage of the most recent development in the improvement of modern man-killing weapons, possesses a marked advantage over a more old-fashioned adversary. In military matters changes of all sorts are constantly necessary for those who would keep pace with the rapid march of modern ideas and educated intelligence. Our progress may be said to depend on change.

To my mind it is a question for serious consideration whether our cavalry, good as it is, but armed as it is, would in a cavalry action be any match for an enemy armed with revolvers, as the Russians now are. Too great attention can hardly be paid at the present time to this point. The question of the best method of arming cavalry has been constantly discussed. The pistol, the sword, the lance, the rifle, have all in their turn had their adherents.

I am not an advocate of converting the cavalry man and his horse into a travelling armoury, but I believe that a light, handy, quick-firing, hard-hitting revolver is essentially a cavalry weapon.

If by the use of a comparatively clumsy revolver the Confederate irregular cavalry was able almost to annihilate the Federal horse twenty-two years ago, what may be expected from cavalry armed with

revolvers of to-day? The edge of the sword is no sharper than it was. The efficiency of the revolver is vastly increased.

It is often lost sight of that during the Franco-Prussian war only six Germans were killed with the sabre, though 100,000 cavalry were engaged for over six months.

France.

The revolver in use in the French Army is a double-action, non-extracting, six-chambered weapon, dating back to 1873. It weighs 2 lbs. 10 ozs., and takes a charge of 10 grains powder, 180 grains lead. The only difference between the weapon supplied to Officers and men is that the former is rather lighter and better finished. I have here the French regulation revolver which belonged to the late Prince Imperial, and which was given by him to Mr. Wilkinson just before the Zulu campaign. Officers, sergeant-majors, drum-majors, drummers, troopers in Cuirassier regiments, and drivers of train are armed and trained with a revolver. Both regular and reserve Officers go through an annual course of revolver shooting. They fire 36 rounds, 24 of which are single practice, 12 continuous, ranges varying from 13 to 30 yards, in addition to 36 rounds of blank. Non-commissioned officers fire 10 rounds of blank. Strict regulations with regard to safety at revolver practice are laid down, only one marksman at a time being allowed to advance within ten paces of the firing-point, and no revolver being allowed to be loaded until the firing-point is reached.

Germany.

The pattern revolver used in the Prussian Service is that introduced in 1879. Officers are supplied with a rather better finished weapon, which costs 3s. more, but is otherwise the same as the men's. It weighs about 3 lbs., the cartridge contains 22·2 grains of powder and 262·4 of lead.

There is a regular annual course of instruction and practice for both Officers and men, the ammunition being supplied by Government; the range from 25 to 100 metres.

All Officers, and in the cavalry non-commissioned officers and trumpeters, also all the troopers in cuirassier regiments, are armed with the revolver.

Italy.

The Officers, non-commissioned officers, and some of the trooper in the cavalry are armed with a Liége revolver.

Spain.

All Officers in the Spanish Army have to be in possession of a revolver. The pattern generally in use is a modified Smith-Wesson double-action revolver taking a cartridge which contains 20 grains of powder.

In the last Carlist rising revolvers were freely used.

Austria.

In Austria all Officers on active service have to provide themselves with the Austrian regulation revolver, which costs about 2*l*. Non-commissioned officers of cavalry, of artillery, of train, of Jägers, and about 70 men per squadron of Lancer regiments, are supplied by Government with revolvers in peace time. They are badly finished weapons, and many serious accidents have occurred owing to the hammer flying off at practice. Both the Officers' and non-commissioned officers' pistols are furnished with a double action.

The Austrians employ iron targets painted white and blue. The bull's eye to be aimed at is circular, but ovals are drawn as shown in Fig. 12 for purposes of scoring. The object of this appears to be to make the man fire low. Figure targets painted natural colours are also laid down in the regulations as to be used.

At aiming drill, to see that a correct alignment is taken, the instructor holds a small target up and places his eye at a pinhole in the centre of the bull.

At drill dummy cartridges are used for instruction in loading, &c.

During the annual course twenty rounds are fired. Besides this the ammunition remaining over, owing to casualties and non-effectives, is used for the worst shots.

England.

In the cavalry, warrant officers, staff sergeants, troop sergeant-majors, farriers, and trumpeters are armed with the revolver; in the infantry, warrant officers and staff sergeants. They fire 12 rounds per annum, 6 right-handed and 6 left. Owing to the small number of rounds allowed, the musketry authorities have been reluctantly compelled to abandon continuous ball practice. When we consider the complications introduced into the new Enfield revolver to obtain rapidity, it is curious that the course of annual practice should be framed to suit the old simple single-action weapon.

Until lately, the Colt's and Adams' pistols have been in use in our Service. These are now being superseded by the self-extracting Enfield.

In Continental armies the Officers are either bound to supply themselves with Government revolvers or they are supplied with them by the State. With us, on the contrary, not only is an Officer not expected to provide himself with the Government revolver, but it is impossible for him to purchase one.

Further, whereas the tendency on the Continent, more especially in the case of Russia, is to develop the use of the revolver, with us a contrary course appears to be pursued. Until lately, all our Lancer regiments were armed with the revolver, but now a carbine has been substituted.

Now, gentlemen, my hobby horse has run his course; he has had his little day; and he has made his mistakes (how numerous they are, no one knows better than his rider), and it is left with you for consideration—

1st. Should Officers be armed with a revolver ?

2nd. Should they be instructed in its use ?

Mr. C. FREDERICK LOWE (South London Rifle Club): Mr. Chairman and gentlemen, there are one or two matters as regards revolvers to which I wish to draw your attention. The first is the remarkable difference between the shape of the butt of the Colt revolver, in universal use in America, and that of the butts of all English-made revolvers. The point for consideration is, which is the best form of butt for the purpose of giving to the muscles of the hand the most powerful grip of the weapon in order to withstand the upward tendency of the barrel. Now, all English revolvers have a lump on them which comes between the thumb and finger. I have seen two excellent shots with the revolver, Mr. Webley and Mr. Winans, each of whom has been wounded by the recoil of the lump in question, whereas, in the Colt, if the revolver comes back, there is no lump to wound the firer's hand, and the extended base enables him to get the greatest muscular power of the three fingers of his hand against the ball of the thumb, so as to resist the upward tendency of the revolver. I submit, therefore, that the grip of the Colt revolver is superior to the grip of an English revolver. There is also a remarkable difference between all English rifles and American rifles as regards the bend of the butt and angle at which the heel plate is set, and I beg to draw the attention of practical makers to that point. It is true that Messrs. Colt supply for the English market a revolver fashioned according to English ideas, and there is a revolver on that table with a saw-handled butt, and also with the lump. What the advantage of the lump on the English revolver may be I cannot make out, but it would appear to have had its origin in the saw-handled butt of the duelling pistol, and I have heard very strong expressions of opinion on the part of practical revolver-makers as to its entire inutility. I quite agree with what Major Kitchener has said as regards the ivory fore sight of Silver's revolver. It is a remarkable fact that the Boers in South Africa had ivory fore sights on the rifles that shot down our troops at Majuba Hill. The great point is that they can be used either in bright or dull light. Of course an ivory fore sight would hardly be strong enough to stand the rough usage of a campaign, but I think Messrs. Silver have solved that problem by sinking the little ivory disc in a metal collar. With reference to the back sight, the great point about a revolver is to get a form of back sight which will give a rapid and at the same time an accurate aim without blur, and Mr. Webley has been kind enough to make a few revolvers in which he has carried out the American pattern, called the buckhorn sight, that is the lower half a pinhole—a pinhole opened out at the top. I hold in my hand a revolver so fitted, which I specially borrowed from Wimbledon, in order to illustrate this. That of course is a moot question. All our English sights ever since the days of Queen Anne, for rifles and revolvers, have been an angular notch, while the Americans make use of the buckhorn sight, both for sporting and military purposes. I venture to think it is possible to improve the back sight of the revolver in that way. As regards the trigger, I find the finger is apt to slip on a smooth trigger, especially if there is any grease. I think, therefore, that the trigger should be slightly roughed, to give the finger a better grip. With reference to the accuracy of revolver shooting, I have heard of an incident that took place in America. There is a class of gentlemen there called cowboys, who are armed generally with Colt's Frontier pistol. One of these cowboys, mounted on a horse, galloped along by the side of a train going at slow speed. He took one shot, and hit the insulator on a telegraph pole in front of him, and then turning round he took a second shot, and knocked off a second insulator behind him. That shows the degree of accuracy which can be attained by a man who knows how to use his weapon. I was told by an Officer who was in the Crimea, that there was a very good revolver then in vogue, called "Tranter's revolver," which had two triggers, similar to the Kynock's, one for revolving the cylinder, and the other for firing it. But the main point to which I would allude is the extraordinary manner in which the Government have done their business with reference to the cartridge. I believe it was found with the Enfield revolver that when the Mark II ammunition was used, which has 18 grains of powder and 265 grains of lead, the bullet being of the diameter of 0.455, that is five-thousandths more than the bore

of the revolver. If you had exploded three cartridges and wanted to extract them to fill up the chamber, all the cartridges came out. To obviate that they raised the diameter of the bullet from 0·455 to 0·476, so that the nose of the bullet would stick in the chamber, and only the exploded cases come out. The result of a defective extracting principle in the Enfield revolver, and of jamming a 0·476 bullet through a 0·450 barrel, has been to destroy the accuracy of every revolver used in Her Majesty's Service, and, as Major Kitchener has shown us, the friction is so great that the 0·476 bullet, Mark III, sometimes breaks into two pieces, and I think it is a great pity indeed that the accuracy of the weapons placed in the hands of our Officers and soldiers for service should be sacrificed in order to hide, as it were, the deficiencies of the Enfield revolver. Mr. Webley has certainly made some very great improvements in the manufacture of revolvers. I am told that the American Government will not purchase any extracting revolvers, because they consider that the problem has not yet been solved, but a leading American manufacturer admitted to me that if a satisfactory self-extracting revolver could be made, the day of the non-extracting revolver was settled. It seems to me, from my limited knowledge, that the problem has been solved, and I venture to think that the last improvement in the Webley and Wilkinson revolver as regards the locking apparatus is satisfactory and efficient. I also think Mr. Webley's anti-fouling collar is most satisfactory. I know there are many gallant Officers in the room who have expressed a strong opinion as to the inefficiency of the Government weapon, and I think I have shown the real reason from which those deficiencies arise. I must apologize for intruding upon you, but I have ventured to do so at the invitation of the gallant lecturer.

MAJOR KITCHENER: With reference to Mr. Lowe's remark, that I found the Government ammunition break up, I think I ought to mention that the ammunition I was using was not actual Government ammunition, but ammunition that I obtained from Mr. Wilkinson. I have not had an opportunity of sufficiently testing the Government ammunition to say that that breaks up; in fact, the few rounds that I had to test did not break. I had about 40 rounds.

MR. FREDERICK LOWE: I found them break up at Wimbledon.

THE CHAIRMAN (Sir F. Middleton): Gentlemen, after the very interesting paper which we have just heard read, I am sure our thanks are due to Major Kitchener. I am only sorry that more of you have not canvassed his remarks, or brought anything to bear upon them, as I hoped would have been the case. I am afraid, as the lecturer said, that there is a want of interest in the British Army about the use of the revolver. It is very evident that in future warfare the revolver will be used a great deal more than it ever has been, especially by cavalry, and it has so far been recognized by the English Government, that whenever we do go on active service, though it is not absolutely recognized as an arm, still every Officer now provides himself with a revolver. And it certainly is of importance that as the fact of the necessity of a revolver is recognized for our Officers, the same weapon should also be furnished to artillery drivers and the drivers of transport. I believe that they have been so furnished in Egypt. It is evident that it is very necessary that a man on horseback, either with artillery or wagons, should have some means of defending himself besides the whip, and therefore we should adopt the revolver, and the practice of training men to fire a revolver should be just as much carried out as training men to fire a rifle. The fact is it is an excessively difficult thing to fire a revolver so as to hit, if you are not accustomed to it. As the lecturer says, it gives confidence to a man to know that he has in his possession a loaded revolver, but in nine cases out of ten, if he came to use it, he would not have so much confidence afterwards, for I doubt very much whether he could hit a haystack. I have seen it tried very often, and I really do not think some men could hit a haystack with a revolver. It is a practice that requires a very great deal of attention, and I hope soon to see that it is recognized as a very important part of our training. They already, I believe, at Wimbledon, have prizes for revolver shooting, and in my humble way out in Canada, I had some revolver shooting introduced, but still it has not met with the support which it ought to have done. The cavalry of the future, I think, will have to depend very much upon the revolver in preference to the carbine. I think that will be recognized after some time. With regard to one of the remarks of

the lecturer as to whether an Officer should be armed with a rifle or revolver, I think there can be very little doubt about that. A revolver is a weapon which, as he said, is a defensive, not an offensive weapon. An Officer armed with a rifle would be apt to be taking pot shots sometimes; his attention, instead of being given to his men, would be probably drawn away in firing at the enemy, and this I have seen done with very bad effect. An Officer nowadays has quite enough to do to look after his men without using the rifle. But when it comes to the question of a revolver, it is quite a different thing; he has that merely as a defensive weapon, and the more he is able to use it the greater confidence it will give him. As regards the remarks of Mr. Lowe, I have no doubt when once it is recognized that the revolver is to be an arm of the Service, we shall get what is proved to be the best weapon. I think you will all agree with me that our thanks are due to Major Kitchener for having brought this subject before us.

OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

COLONEL v. LÖBELL'S¹ ANNUAL REPORTS UPON THE CHANGES AND PROGRESS IN MILITARY MATTERS DURING 1885.

By Lieutenant-Colonel H. HILDYARD, Highland Light Infantry.

THE twelfth yearly issue of Colonel von Löbell's invaluable work has been published, and contains a complete review of military affairs on the Continent, and in many countries elsewhere, for the year 1885. The importance of the work increases as the successive annual publications take place, and it forms the only complete and accurate work which treats of the armed forces of the world. Each year the various changes that have occurred during the foregoing twelve months in the organization, armament, and training of the several military Powers are duly chronicled, while from time to time a concise account is given of the complete organization of each of them. To those military men, therefore, who are anxious to extend their study of organization and training beyond the scope afforded by the army to which they may belong, Colonel von Löbell's work cannot but be of the utmost assistance. The following compilation from its pages must be necessarily short and incomplete. It has been restricted to such portions as have appeared to offer most interest to British Officers; but it should be distinctly stated that it can offer no sufficient substitute for the work itself, to which those who have a knowledge of German—and they are now happily many—are referred.

The present issue is framed on the same lines as its predecessors. In the first part the several armies are dealt with in regard to their organization and the various laws and orders affecting the Officers, non-commissioned officers, and men. The Belgian Army has been selected as the one of which a complete account should be given, and a short description is also given of the armed forces of the minor military States of Annam, Morocco, Switzerland, Siam, and the United States of America. The second part is devoted to the tactics of the several arms, the question of small arms, artillery armaments, and military ballooning, which has latterly assumed an increased

¹ Jahresberichte über die Veränderungen und Fortschritte im Militärwesen. XII Jahrgang, 1885, herausgegeben von H. v. Löbell, Oberst z. Disp.—Berlin, Ernst Siegfried Mittler und Sohn. 1886. Pp. 663; 9·5" x 6·5" x 1"; weight, 2lb. 4 ozs. Price 8s. 6d.

importance. The third and last part is occupied with the military history of the year, comprising the Servo-Bulgarian War, the French expeditions to Madagascar and Tonquin, and our own operations up the Nile and in the Eastern Sûdan.

Germany.

There are few changes of any kind recorded in the German Army, and such as there are do not for the most part call for any particular remark. The question of the height of recruits has been so much debated with us, that it will not be without interest to reproduce the standards approved for the German Army in February, 1835.

| | Maximum. | Minimum. |
|---|----------|----------|
| For all the Guard corps except railway troops ..... | .... | 1·70 m. |
| Ditto by special authority in exceptional cases ..... | .... | 1·67 „ |
| Light cavalry of the Guard .... | .... | 1·65 „ |
| Infantry ..... | .... | 1·57 „ |
| Rifles | 1·75 m. | 1·57 „ |
| Cuirassiers and lancers | 1·75 „ | 1·67 „ |
| Dragoons and hussars..... | 1·72 „ | 1·57 „ |
| Horse artillery | 1·75 „ | 1·62 „ |
| Field „ ..... | .... | 1·62 „ |
| Garrison „ ..... | .... | 1·67 „ |
| Pioneers and railway troops .... | .... | 1·62 „ |
| Train | 1·75 „ | 1·57 „ |

Of the Guard at least one-half must be 1·75 m. and over.

Great attention has been paid of late years in the German Army to the improvement of the musketry instruction of the troops, and a new book has been issued. Regimental Commanders who had not previously gone through a course at the Musketry School at Spandau, had to attend one in October last, as well as two infantry Staff Officers from each army corps, four Officers of the General Staff, the Commandants of the non-commissioned officers' schools, and a regimental cavalry Commanding Officer from four of the army corps.

Revised instructions have been issued to regulate the expenditure of the sums available for field manœuvres and field firing, by which it is directed that the following subjects shall be given precedence according to their order :—

1. The field training of the infantry and rifles, as well as of the non-commissioned officers' schools stationed in garrisons, the situation of which does not offer facilities for such instruction in the immediate vicinity.

2. The field manœuvres of mixed detachments from the same or from neighbouring garrisons.

3. The tactical tours of infantry Officers. The scope of these is to be limited to the solution of simple tactical questions and conditions, and they must not therefore be framed on the model of the more extended General-Staff tours.

The money allotted to these objects is handed over yearly in a lump sum to each of the Generals commanding army corps, the Inspectors of Rifle Battalions and of the Infantry Schools, who subdivide the amount at their discretion ; but it is distinctly understood that this subdivision should not be carried further than necessary. Where, for instance, the available funds will not suffice to allow of the training under all three heads being carried out, it would be devoted entirely to the first rather than extended proportionally to all three.

It has always been recognized by those responsible for the efficiency of the German Army, that a necessary condition to the success of the system of short colour service and a reserve is, that the latter shall be called out for training periodically, and very wisely the Government has not shrunk from carrying this out on account of the expenditure it entails. As a matter of fact, to any State having a military organization based on short service with the colours, the necessary expense will always be more than compensated for by the advantages to be gained by periodical training, for however short a time. It is not alone the efficiency of the Reserve men themselves that has to be considered, though this in itself is a very important point in these days of constant change in small arms, and in the conditions of attack and defence consequent upon it. But perhaps still more important is the moral effect of the presence of Reserve men in the ranks from time to time both on these and on the younger soldiers still serving with the colours. It might be supposed that in Germany, if anywhere, it could be dispensed with; for there are in addition the periodical musters of all Reserve men at the headquarters of their respective companies in the district in which they reside. But German Officers are of opinion that these are insufficient to maintain the military bond that should exist between those who have passed back into civil life and the formations to which they may at any moment be called back; and it is a matter of astonishment to them that a system should be accepted as satisfactory which allows of the military bond being virtually severed, as is the case in our Army, when the men pass to the Reserve on the completion of their colour service.

The number of men of the Landwehr and Army Reserve called out last year was as follows, including non-commissioned officers, hospital attendants, &c. :—

| | |
|-------------------------|-------------|
| Infantry | 93,200 men. |
| Jägers and rifles | 2,700 " |
| Field artillery | 6,624 " |
| Garrison " | 5,700 " |
| Pioneers | 2,500 " |
| Railway regiment..... | 450 " |
| Train | 5,346 " |

116,520

The duration of the drills was limited, as in former years, to twelve days. As regards the cavalry reserve, power was given to call up 26 men per army corps, to be borne as supernumeraries with the cavalry regiments for a period of six weeks; and it was left to the discretion of the Generals commanding corps to employ them with the train.

Similar arrangements were made for the exercise of a proportion of the reserves of the Bavarian Army, of whom 16,720 were called up, exclusive of 50 cavalry men, and also of 500 infantry and jägers, called up specially for the greater manœuvres only.

The periodical exercises of the Ersatz Reserves were conducted with the same regularity, those who came up for the first time being drilled for ten weeks, those in their second year for four weeks, and those in their third year for fourteen days.

During the past year these numbered—

| | |
|-----------------|-------------------------|
| 1st drill | 15,498 men of all arms. |
| 2nd " | 10,000 " |
| 3rd " | 8,500 " |

Total 33,998
3 T 2

In Bavaria the total number was 5,200.

The whole, therefore of the Army and Ersatz Reserves belonging to the German and Bavarian Armies exercised during 1885 amounted to nearly 174,000 men.

Belgium.

There is no law by which the organization of the Army in time of war is fixed; but judging from the procedure on its mobilization in 1870, the following may be taken as its probable composition:—

i. An army of observation consisting of 2 army corps, each of 2 divisions and a reserve cavalry division.

ii. A movable division for the intrenched camp of Antwerp, composed of the infantry battalions still available, and the 4th battalions and 5th squadrons of regiments which are formed on mobilization.

iii. Some troops for garrison duty, including the regiments of siege artillery and most of the special companies of artillery and engineers, but these are very insufficient for the duties required.

The strength of the several forces is estimated to be as follows:—

Composition of the Army of Observation.

| | Officers. | Men. | Horses. | Guns. | Wagons and carts. |
|---|--------------|---------------|---------------|------------|----------------------|
| Headquarters | 20 | 36 | 91 | .. | 4 |
| 2 army corps | 1,768 | 58,530 | 13,854 | 204 | 1,324 |
| 1 reserve cavalry division | 163 | 2,728 | 2,882 | .. | 23 |
| Ambulance for headquarters ... | .. | 6 | 15 | .. | 4 |
| Railway company | 5 | 214 | 19 | .. | 4 |
| $\frac{1}{2}$ company engineer park | 8 | 360 | 244 | .. | 52 |
| 1 section field telegraph | 2 | 62 | 20 | .. | 4 |
| 1 police detachment | 1 | 50 | 52 | .. | — |
| Total | 1,967 | 61,986 | 17,177 | 204 | 1,415 |

5th Division. Movable Division for the Entrenched Camp at Antwerp.

In time of peace this organization does not exist, but on mobilization it is formed, on the same lines as the other divisions, to serve as a reserve to the army of observation. Its strength is fixed at 376 Officers, 13,269 of other ranks, 2,232 horses, 24 guns, and 191 wagons and carts. The infantry of the division is formed by the 1st battalions of the 3 Rifle regiments and the Grenadier regiment, and the 4th battalions of these, and of the first 4 regiments of the line, the whole being organized in 4 regiments, each of 3 battalions. The cavalry is composed of 1 regiment furnished by the 5th squadrons of each of the cavalry regiments. The artillery is provided by the 4 reserve field batteries of the 1st and 3rd Artillery regiments.

Garrison Troops.

After deducting the formations required for the army of observation and the movable division, only the following troops would remain available for garrison duties:—

Infantry.—12 line battalions, viz., the 4th battalions of the 5th to the 14th

regiments, the 2 first regiments of Rifles, and the 6th Carbinier battalions, in all 260 Officers, 10,764 men, 65 horses, 26 wagons.

Cavalry.—The 4 reserve squadrons of the 4 Lancer regiments and the School of Equitation, viz., 38 Officers, 677 men, 706 horses, and 5 wagons.

Artillery.—2 field batteries (the reserve batteries of the 2nd and 4th field artillery regiments), and 3 regiments of siege artillery; in all 53 batteries of a strength of 324 Officers, 9,907 men, 602 horses, and 12 field guns.

Engineers.—The Engineer regiment, except $5\frac{1}{2}$ companies, and 3 special companies, numbering 55 Officers, 1,645 men, 12 horses.

The total strength of the garrison troops of all arms is consequently 677 Officers, 22,993 men, 1,398 horses, 12 guns, and 51 wagons.

The total strength of the Belgian Army on a war footing is as follows:—

| Disposition. | Officers. | Men. | Horses. | Guns. | Wagons. |
|---------------------------|-----------|--------|---------|-------|---------|
| Army of observation | 1,967 | 61,986 | 17,177 | 204 | 1,415 |
| Movable division | 376 | 13,269 | 2,232 | 24 | 191 |
| Garrison troops | 677 | 22,993 | 1,385 | 12 | 51 |
| Total | 3,020 | 98,248 | 20,794 | 240 | 1,657 |

It must be observed, however, that in case of mobilization a very large number of Officers would be required, for the provision of whom no satisfactory arrangements have been made, and also that the existing recruiting law cannot provide the number of men required to complete the army on a war footing. This law provides for eight classes of so-called militia of 13,300 men, besides a reserve of two classes, and such number of men as may wish to serve voluntarily. These classes as a fact do not reach the normal number, but supposing they should do so, we have—

8 classes of militia, at 13,300 = 106,400 men.

Deduct 30 per cent. waste = 31,920 „

There remain 74,480 „

Serving voluntarily 5,000 „

Reserve (9th and 10th classes
exclusive of married men) 11,000 „

Total 90,480 „

Bulgaria.

The year 1885 afforded the opportunity for testing the state of the army, which had been first called into existence only seven years previously. The result was more favourable than had been contemplated by those even who were well acquainted with the Bulgarian Army. It is not possible to estimate with any accuracy the number of men actually placed under arms during the operations which followed the mobilization; for after the junction with the Army of Eastern Roumelia, the forces of the two States were, so far as published accounts are concerned, reckoned together. The combined strength in the middle of November was given by Bulgarian reports as 110,000 men. About three-fifths of these, or 60,000 men, are said to have composed the Bulgarian contingent; but as a matter of fact this can hardly have been the case, for towards the end of November, Prince Alexander, after concentrating the whole of his available forces—both Bulgarian and East Roumelian—at Slivnitza, could only dispose of 50,000 men.

The mobilization of the 1st levy answered the expectations formed in von Löbell's Report for 1884, some of the infantry regiments being raised even considerably over the regulated strength, but the want of trained Officers was seriously felt. As regards the 2nd levy, by an order of 1884, each infantry regiment was to form two reserve battalions, one of which was to be mobilized and expanded eventually into a regiment, the other being stationary as an Ersatz battalion. How far this order was carried out in its entirety does not appear, but in any case effect was given to it so far as to complete for each regiment the extra field battalion, and at least some complete regiments were formed and arrived at Widdin.

In the same way the available information as to the number of volunteers and the Landsturm formations is incomplete.

During the period immediately following the declaration of war, volunteers came in in considerable numbers. A corps was formed out of Macedonians, and a brigade about 4,000 strong, which operated to the north of the main army, was composed almost entirely of volunteers. The Landsturm or National Guard was called out, and formations of it came into action.

The equipment and armament of the army formed from the 1st levy were satisfactory, but for the further formations little was available. The weakest point was the train, which may be said to have been only called into existence at the outbreak of the war, and, owing to the scarcity of draught horses in the country, a portion of the 3,000 wagons which were requisitioned had to be drawn by the bullock-teams in ordinary use.

The mobilization and concentration were effected under most unfavourable and disheartening conditions, which must have tried the best troops, and the comparative celerity and regularity with which they were completed were most creditable to the spirit and endurance of the young army. In spite of bad weather and consequently heavy roads, the troops marched from Sarembey to Sofia, a distance of 100 kilometres, over the Ichtiman Pass, in 48 hours, and one regiment—the Primorski—covered 95 kilometres in 32 hours, during which, of an effective strength of 4,500, only 62 men fell out.

In action they gave proof of equal spirit and discipline, and both on the offensive and defensive they showed themselves far superior to their Servian opponents.

China.

It is a notable sequel to the events which brought the hostilities in Tonquin to a close, that China, while gaining a striking advantage at Langson, has been able to recognize clearly that, in the present condition of her army, it cannot compete with a European force. The fact was sufficiently patent to others; but that the Chinese Government should acknowledge it could not have been expected, looking to the past history of the Empire, and still less so that steps should have been taken to remedy it. Such is, however, the case; for, yielding to the urgent representations of Li Hung-chang, it has been decided to remodel the entire army on the German system. For the moment such a decision is not likely to have any immediate effect upon the efficiency of the Chinese Army as against a European force. But when we come to consider the material of which a large portion of the army is formed, and the immense resources at the disposal of the Government, we may look forward to the future development of this new departure as likely to create in time a force which will have to be reckoned with seriously in any complication with the Celestial Empire.

For the present the experiment has been restricted to the force under Li Hung-chang's immediate command, amounting to about 10,000 men. These troops have actually been formed after the German model, and have been located in standing camps between Tientsin and the Gulf of Petchili. The infantry is formed in regiments of 14 companies armed with the Austrian

rifle ; they are drilled in accordance with the German regulations and instructed in field duties. Great weight is given to musketry instruction, and the men have to shoot through the German third class each year, but the results attained are not yet known.

The artillery is composed of 6 field and 3 mountain batteries each of 4 guns, the former being of Krupp's rifled breech-loading 7·85 cm., the latter 7·5 cm. The field batteries are horsed by 6 Mongolian ponies equipped like the German artillery horses ; the mountain guns are carried by 4 horses of stouter build, equipped after their own way. The German words of command have been adopted, and have led to some difficulty from the impossibility of rendering them in the Chinese tongue without considerable circumlocution. Notwithstanding this a fair measure of efficiency has been attained.

But here the reorganization as at present effected comes to a standstill. The cavalry remains as it was, except that it is now armed with the Mauser, Spencer, and Winchester rifles. An Engineer corps and train have still to be formed, as contemplated by the new scheme.

The lesson learnt from the brief hostilities with France have not been restricted to the army. The affairs of Sheipoo and the Min ports led sufficiently clearly to the conclusion that neither the navy nor the coast defences were in such a condition as to stand against a European fleet. It has, therefore, been determined to reorganize the former and centralize the administration under a Board of Admiralty, while the forts are to be completely remodelled.

France.

From the recruiting statistics it appears that the total number of men liable for service during 1884 was 313,951, of whom 7,784 were absentees from various causes. The following were excused from immediate service :—

| | |
|--|--------|
| Under Art. 17 of the law regulating recruiting | 50,643 |
| Physically unfit | 37,842 |
| Conditionally excused or already serving as volunteers | 31,525 |
| Put back during 1882-83 | 39,105 |
| Only fitted for the administrative services | 16,090 |

The yearly contingent for the army was apportioned as follows :—

| | 1st Portion. | 2nd Portion. | Total. |
|-------------------------------|---------------|--------------|---------------|
| Of the 1884 class | 94,422 | 34,057 | 128,479 |
| Put back from 1883 class | 7,683 | 3,253 | 10,936 |
| „ 1882 „ | 3,716 | 802 | 4,518 |
| | <hr/> 105,821 | <hr/> 38,112 | <hr/> 143,933 |

After deducting 9,231 non-effectives spread over all arms, the contingent was allotted in the following manner :—

| | 1st Portion. | 2nd Portion. | Total. |
|------------------------------|--------------|--------------|--------------|
| I. <i>Infantry</i> — | | | |
| Line regiments | 59,534 | 26,526 | 86,060 |
| Rifle battalions | 4,891 | 681 | 5,572 |
| Zouave regiments | 1,570 | .... | 1,570 |
| Algerian tirailleurs | 100 | .... | 100 |
| African light infantry | 3 | .... | 3 |
| Foreign regiments | 4 | .... | 4 |
| | <hr/> 66,102 | <hr/> 27,207 | <hr/> 93,309 |

II. *Cavalry* (only 1st portion)—

| | |
|--------------------------|-------|
| Cuirassiers | 2,202 |
| Dragoons | 4,734 |
| Rifles | 3,554 |
| Hussars | 2,089 |
| Chasseurs d'Afrique..... | 590 |
| Cavalry school | 11 |

13,180

| | 1st Portion. | 2nd Portion. | Total. |
|--|--------------|--------------|--------------|
| III. <i>Artillery</i> — | | | |
| Artillery regiments | 10,255 | 5,681 | 15,936 |
| Pontoon | 751 | .... | 751 |
| Garrison artillery battalions | 2,307 | 2,907 | 5,214 |
| Artificers and laboratory companies | 128 | .... | 128 |
| | <hr/> 13,441 | <hr/> 8,588 | <hr/> 22,029 |

IV. *Engineers*—

| | | | |
|-----------------------------|-------------|-----------|-------------|
| Engineer regiments | 1,932 | 680 | 2,612 |
| 20th Engineer Battalion ... | 80 | .... | 80 |
| Railway companies..... | 92 | .... | 92 |
| | <hr/> 2,104 | <hr/> 680 | <hr/> 2,784 |

| | | | |
|----------------|-------|-----|-------|
| V. Train | 1,900 | 500 | 2,400 |
|----------------|-------|-----|-------|

Of the above, those belonging to the 1st portion joined on the 1st and 5th December, 1885, those of the 2nd portion on the 27th November.

Italy.

The increase contemplated by the law of the 29th June, 1882, has been carried into effect, and a permanent addition to the army of the following formations, by which the number of army corps has been increased from 10 to 12 :—

- 16 infantry regiments.
- 2 bersaglieri „
- 2 cavalry „
- 2 field artillery regiments.
- 8 mountain batteries.
- 4 horse artillery batteries.
- 1 engineer regiment.
- 12 commissariat companies.

The total number of infantry regiments is now 96.

By an order of the 22nd March, 1885, the Alpine companies have been permanently allotted to six frontier districts, viz. :—

| | |
|-----------------|---|
| Mondovi..... | 1st to 11th companies, except 7th company. |
| Bra | 12th to 23rd companies. |
| Savigliano | 28th to 36th „ |
| Turin | the 7th, the 24th to 27th companies, and 38th to 43rd companies. |
| Milan | 44th to 55th „ |
| Conegliano.... | 56th to 72nd „ |

In accordance with the recommendation of a Committee of General Officers, the period of active service for the cavalry soldier has been reduced from four years to three, the period in force for the other arms. The present organization of the militia services is as follows :—

I. *Mobile Militia*—

(The Peninsula)

| | |
|----------------------|--|
| Infantry..... | 41 regiments of three battalions of 4 companies. |
| Bersaglieri | 20 battalions of 4 companies. |
| Alpine companies | 36, each equal to 2 line companies. |
| Field artillery | 12 brigades of three batteries of 8 guns. |
| Garrison „ | 24 companies. |
| Engineers | 14 companies sappers. |
| „ | 2 railway companies. |
| „ | 2 telegraph „ |
| „ | 2 pontoon „ |
| „ | 4 train „ |

Sanitary and commissariat services, each 12 companies—

(Sardinia)

| | |
|---------------------------------|---|
| Infantry | 3 regiments of three battalions of 4 companies. |
| Bersaglieri..... | 1 battalion of 4 companies. |
| Cavalry | 1 squadron. |
| Artillery | 1 brigade of 2 field and 2 garrison companies. |
| Engineers | 1 sapper company. |
| Sanitary and commissariat | each 1 company. |

The weak point of these formations lies in the insufficiency of the cadres. In time of war 12 divisions of about equal strength with those of the first line would be formed from them.

II. *Territorial Militia*—

| | |
|---------------------------------|---|
| Infantry | 320 battalions of 4 companies. |
| Garrison artillery.... | 100 companies. |
| Engineers | 30 „ |
| Alpine companies .. | 72 in 30 battalions. |
| Sanitary and commissariat | 13 companies each and one for Sardinia. |

The same defect detracts from the efficiency of these formations as in the case of the mobile militia, viz., the incomplete and insufficiently trained cadres. A large number of the subaltern Officers have never served in the army, as is also the case with the men, and must be so under the present conditions of service, unless the strength of the standing army be still further increased. The following comparative table shows the increase both in the number of men serving, and of those on furlough liable to recall since 1883, as well as the total armed force available on mobilization :—

| Distribution. | 30th September, 1883. | | | 30th June, 1885. | | |
|---|-----------------------|------------------|------------------|-------------------|------------------|------------------|
| | With the colours. | On furlough. | Total. | With the colours. | On furlough. | Total. |
| Standing army— | | | | | | |
| 1st Category | 170,500 | 324,372 | 494,872 | 226,013 | 338,022 | 564,035 |
| 2nd " | .. | 240,040 | 240,040 | .. | 289,985 | 289,985 |
| Officers | 12,914 | .. | 12,914 | 13,510 | .. | 13,510 |
| Ersatz Officers | .. | 2,939 | 2,939 | .. | 3,418 | 3,418 |
| Total | 183,414 | 567,351 | 750,765 | 239,523 | 631,425 | 870,958 |
| Mobile Militia— | | | | | | |
| 1st Category | 174,887 | .. | 174,887 | .. | 151,894 | 151,894 |
| 2nd " | 164,347 | .. | 164,347 | .. | 163,592 | 163,592 |
| Officers | 1,106 | .. | 1,106 | .. | 937 | 937 |
| Ersatz Officers | .. | 910 | 910 | .. | 1,401 | 1,401 |
| Total | .. | 341,250 | 341,250 | .. | 317,824 | 317,824 |
| Territorial Militia— | | | | | | |
| Men | .. | 1,017,212 | 1,017,212 | .. | 1,207,864 | 1,207,864 |
| Officers | .. | 4,742 | 4,742 | .. | 5,442 | 5,442 |
| Total | .. | 1,021,954 | 1,021,954 | .. | 1,213,306 | 1,213,306 |
| Officers of Auxiliary Services | .. | 1,533 | 1,533 | .. | 1,902 | 1,902 |
| Reserve Officers unattached | .. | 3,748 | 3,748 | .. | 3,354 | 3,354 |
| Total | .. | 5,281 | 5,281 | .. | 5,256 | 5,256 |
| General total | 183,414 | 1,935,836 | 2,119,250 | 239,523 | 2,167,811 | 2,407,344 |

Morocco.

The Report upon the forces at the disposal of the Sultan of Morocco is not without interest, from the fact that this State is the only one in North Africa that has been able to retain its independence, and that the day may probably arrive before long when it will have to take up arms to defend its integrity. The permanent force is composed of four formations, the Bokhari or Black Mounted Guard, the Mchazniyyeh or local forces, the Askari infantry organized on the European model, and the Töbdschiyyah, or artillery. Of these, the Bokhari, Askari, and artillery are regularly maintained, armed and drilled, and form by comparison an efficient force; but they are few in number and are not to be compared, except as regards endurance, with European troops. The Mchazniyyeh are mounted contingents at the disposal of the Governor of each district, for the maintenance of order, and are not regularly trained as soldiers. Armed with the long flint musket they are not a formidable foe except against natives equally badly equipped; but they are capable of being turned into a useful light cavalry for scouting and raiding purposes. The bulk of the available forces are the Harkah, which includes the whole of the remaining efficient male population; but the great bulk of these cannot really be regarded as available for warlike operations, and would be an incumbrance to the fighting force, which might probably number about 80,000 to 100,000 men.

The numbers estimated in the Report are as follows:—

| | |
|-------------------|-----------------|
| Bokhari | 5,000 cavalry. |
| Mchazniyyeh | 25,000 „ |
| Askari | 6,300 infantry. |
| Artillery | 840 „ |
| Harkah | 300,000 „ |
| <hr/> | |
| Total | 337,140 |

Austria-Hungary.

During the past year the reorganization of the Austrian Army on the territorial system, which was inaugurated in 1882, was completed by the necessary changes in the organization of the field artillery. As yet, however, it has not been possible to carry out in their integrity the arrangements for the future quartering of the troops, on account of the want of accommodation in some of the new military districts. This defect is in course of being remedied by the building of barracks, stores, magazines, riding schools, &c.; but at the beginning of 1886, in certain districts no progress had been made beyond the plans and proposals for construction. Notwithstanding this, it must be regarded as an important step towards the increased efficiency of the army that in the majority of the districts the troops are already distributed as designed by the territorial organization, which must ensure a material decrease in the time required for mobilization.

Of the whole 102 infantry regiments at least one battalion and the Ersatz-cadre are quartered at the territorial headquarters. All 4 battalions of 50 regiments are stationed there, or in the immediate vicinity; 33 regiments are quartered with 3 battalions away from the territorial station, but within the army corps district. Of the foregoing 83 regiments, 28 battalions are detached with the army of occupation in Bosnia-Herzegovina. The remaining 19 regiments have three battalions stationed elsewhere than in the army corps district. The Tyrol Jäger regiment has 9 battalions and the Ersatz battalion cadre in its own district, and the tenth battalion in Herzegovina. Of the 32 Jäger battalions, 10 are in their proper districts,

16 elsewhere, besides 6 with the army of occupation. The cavalry have 28 regiments in their own districts and 13 outside them. Only one of the 14 artillery brigades is not in its proper district. The engineers, pioneers, sanitary troops, and train are all at the stations allotted to them.

The recruiting statistics show that of 858,041 liable in the various classes in 1884, only 120,047 were found fit, of which number 95,822 were taken for the army. The disposal of those liable was as follows :—

| | |
|---|---------|
| Temporarily dispensed with | 46,409 |
| Absentees | 41,098 |
| Dismissed or postponed for physical disability | 649,706 |
| Found fit | 120,047 |
| Not decided upon before date of calling up | 781 |

Some interesting statistics are given in regard to the height of those called up. The total number dismissed on account of not attaining to the minimum height (1·554 m.) was 92,979. The proportion of these according to nationality was as follows :—

| | |
|-------------------------------------|---------------|
| Croats | 206 per 1,600 |
| Moravians, Czechs, and Slovaks | 243 „ |
| Germans | 251 „ |
| Roumanians | 300 „ |
| Ruthenians | 401 „ |
| Magyars | 436 „ |
| Poles | 476 „ |

Taking the whole number found unfit for service, the Magyars had proportionally the greater number, and the majority of them were in height above the required standard, whereas the opposite was the case with the other nationalities.

The following table shows the average age of the Officers of the senior ranks of the several arms actually serving at the beginning of 1885 :—

| Branch of the Service. | Colonel. | Lieut.-Col. | Major. |
|---------------------------|----------|-------------|--------|
| General staff | 45·7 | 42·3 | 39·2 |
| Infantry and Jägers | 51·8 | 51·1 | 47·9 |
| Cavalry. | 47·7 | 46·4 | 45 |
| Artillery | 51·7 | 51·6 | 47·4 |
| Engineers | 52·9 | 49·1 | 46·4 |
| Pioneers | 52 | 52 | 48·1 |
| Sanitary service | 55 | 55 | 54 |
| Train | 56·5 | 55·7 | 52·7 |

The organization of the field and garrison artillery has, as already stated, been adapted during the past year to meet the territorial scheme for the Army.

The field artillery now consists of 14 corps artillery regiments and 28 independent heavy battery divisions. In each army corps the corps artillery regiment and two independent heavy battery divisions form an artillery brigade. These artillery brigades follow the numbering of the army corps to which they belong, so also do the artillery regiments. The independent heavy battery divisions belonging to the 1st Artillery Brigade are numbered

1 and 2 ; those of the 2nd, 3 and 4, and so on. In time of peace each of the 14 corps artillery regiments is divided into the regimental staff; the 1st heavy battery division composed of 3 heavy batteries numbered from 1 to 3; the 2nd heavy battery division of 2 light batteries with the numbers 4 and 5; the ammunition park cadre and the Ersatz dépôt cadre.

In immediate connection with the respective corps artillery regiments are, further, with the 1st, 2nd, 4th, 5th, 6th, 7th, 10th, and 11th a horse artillery battery division composed of the divisional staff and 2 horse artillery batteries numbered 1 and 2; with the 3rd, 4th, 5th, 7th, 8th, 9th, 12th, 13th, and 14th a heavy battery division, on a lower peace establishment, numbered from 29 to 37, each consisting of the divisional staff, 3 heavy batteries numbered from 1 to 3, and the ammunition park cadre; with the 1 to 3 and the 6 to 14 a mountain battery.

On mobilization are formed from each ammunition park cadre a corps ammunition park and also 2 columns for the army ammunition park; from the Ersatz dépôt cadre, the Ersatz dépôt for the regiment and from the ammunition park cadres of the heavy battery divisions 29 to 37, divisional ammunition parks numbered the same. Each of the 28 independent heavy battery divisions is composed of the divisional staff, 3 heavy batteries numbered from 1 to 3, the ammunition park cadre, and the Ersatz dépôt cadre.

With an army in the field the corps artillery regiments with the 1st and 2nd battery divisions and the corps ammunition park form the corps artillery; the independent heavy battery divisions 1 to 28, the heavy battery divisions 29 to 37, detached from the corps artillery regiments with the ammunition parks belonging to them, and horse artillery divisions form the divisional artillery of the infantry or cavalry divisions respectively. The army ammunition park is formed from the 1st and 2nd ammunition columns of the corps artillery regiments.

The garrison artillery is composed of 12 garrison artillery battalions, each consisting of the staff and 6 companies, of which the 6th has in peace-time only a cadre. To the 9th battalion belong 3 mountain batteries, which are doubled on mobilization. The heavy batteries have 9-cm. guns, the light and horse batteries 8-cm., and the mountain batteries 7-cm.

In time of peace each artillery brigade is stationed in the territorial district of the corps to which it belongs, with the exception of the 14th, which is in the 2nd army corps district. The corps artillery regiments are at the station of the corps headquarters, the independent heavy battery divisions at that of the infantry division to which they are allotted by the *ordre de bataille* of the field army. The garrison artillery battalions are distributed among the several garrisons. The ammunition park and Ersatz dépôt cadres are at the headquarters of the corps artillery regiments, and the 6th garrison company cadre at that of its battalion.

The entire corps artillery regiment is commanded by a Colonel; the independent heavy battery divisions and the garrison battalions by a Lieutenant-Colonel or a Major. The heavy battery divisions belonging to the corps artillery regiments are under the command of a Lieutenant-Colonel, Major, or Captain.

The whole of the necessary equipment, armament, and field stores required on mobilization for every portion of the corps artillery regiments are kept complete at the headquarters of regiments, and those for the independent divisions and the garrison battalions at their headquarters. The necessary increase in horses is provided for by requisition under the existing law.

The Austrian Landwehr was during 1885 brought into accord with the territorial system, and placed under the direct command of the army corps district commanders. The separate battalions have been amalgamated into regiments, to be formed on mobilization under the command of Officers

previously designated; the stations of the battalions made coincident with those of the line battalions, and arrangements made for the formation of Landwehr brigades and divisions, measures which are calculated to facilitate the formation of efficient fighting bodies, and place the Austrian Landwehr on an equal footing with the Hungarian in this respect.

An important duty of the corps commanders in relation to the Landwehr is the completion of the corps of Officers not included in the cadres, which is provided for by means of at least one aspirant school in each army corps district. A General or a Colonel is attached to each corps commander to assist him in the administration of the Landwehr.

The Landwehr infantry consists of 82 battalions, for which cadres exist in peace-time, from which on mobilization a battalion of 4 companies, 1 Ersatz, and eventually 1 reserve company are formed. These battalions would as a rule be combined in regiments of 3 or 4 battalions, the formation and command of which are fixed beforehand. A separate organization is retained for the 10 rifle battalions of the Tyrol-Vorarlberg. Landwehr divisions to be included in the *ordre de bataille* of the field army are also provided for, consisting of 2 brigades, 14 to 15 Landwehr battalions, 3 to 4 squadrons from the Regular Army or the Landwehr, 3 batteries from the Army, and also technical and administrative troops.

The Landwehr cavalry consisting of 6 regiments, 3 of which are dragoons and 3 lancers.

A new scheme has been published for the war formation of the Hungarian Landwehr, by which a half brigade composed of 4 battalions will number 84 Officers and 3,832 men, of whom 74 Officers and 3,592 men combatants.

The strength of an independent Honved battalion is 22 Officers, 960 men, of whom 18 Officers and 898 men combatants.

The war strength of a Landwehr Hussar regiment is 30 Officers, 743 men, and 752 horses, of whom 25 Officers and 609 men combatants, with an Ersatz squadron of 8 Officers, 170 men, and 161 horses.

Towards the end of February, 1886, a new Landsturm law was laid before the Parliaments in Vienna and Buda-Pesth, based generally on that in force in Germany. It differs in this respect, that in the Austrian law the first levy of the Landsturm, viz., those not belonging to the Army or the Landwehr, whether they have already served or not, between 19 and 37 years of age, are liable to be allotted to the Ersatz Reserve for the Army or Landwehr if required. The second levy, viz., those capable of bearing arms between 37 and 42 years of age, and retired Officers up to 60, would then form, strictly speaking, the Landsturm, and provide for local defence. This measure is considered necessary on account of the insufficient strength of the Austro-Hungarian Army as at present constituted. This amounts to 1,150,000 men of the Regular Army and Landwehr on a war strength, exclusive of an Ersatz Reserve of 80,000 men for the Army and 130,000 for the Landwehr. The experience gained by the operations in Bosnia-Herzegovina have shown that, in case of war in a country in which bad roads and difficult ground require extraordinary exertions on the part of the troops, this number would be insufficient to meet the waste to be expected.

East Roumelia.

The precise strength of the force contributed by East Roumelia to the combined Bulgarian Army in September, 1885, cannot be ascertained. Immediately after the *coup d'état* by which the junction was effected the infantry consisted of 20 companies, including 2 instructional companies, numbering 3,000, exclusive of Officers. A squadron of cavalry, a half battery of artillery, and a company of sappers raised the total force to about 3,500 of all ranks.

On mobilization, following the scheme in force, each of the twelve military districts should have furnished a battalion of the first levy for the Militia and a battalion of the second levy, besides an Ersatz company for the former battalion. No establishment was fixed for the third levy, or reserve to the Militia, which would be formed into provisional battalions and companies. The numbers required to complete the 12 battalions of each levy were 264 combatant Officers, 1,248 non-commissioned officers, and 10,380 men. Of the 12 yearly classes of the Militia liable by law the 5 youngest, numbering about 20,000, had been trained in the cadres of the Militia. Allowing for the waste the number obtainable was sufficient to complete all the battalions of the first levy and partially those of the second levy.

The same difficulty was, however, experienced in East Roumelia as in Bulgaria in the matter of Officers and non-commissioned officers, on account of the withdrawal of the Russians who had been serving in the Army. This reduced the number of available Officers to 107 ; and to remedy this in some degree 40 were taken from the battalions of the first levy. But this, while helping the regular battalions, still further reduced the already insufficient number available for the Militia, for which only 147 were forthcoming out of the 528 required.

The deficiency was still further increased by the requirements of the Ersatz troops. The only possible way of filling these deficiencies was by employing former Officers, mostly Turks, and by appointing non-commissioned officers, who could be very ill spared, and who, further, had not the education to fit them for the position of Officers.

The result was that the 24 battalions of the first and second levy, though complete in men, had an insufficiently formed staff of non-commissioned officers, and only 10 Officers per battalion, being 2 per company. Very few battalions were formed from the third levy, but on the other hand a number were raised by means of volunteers, who came forward in great numbers.

At the end of October, 1885, the strength of the infantry was estimated at from 34,000 to 36,000 men, who were distributed between the 24 battalions of the first and second levy, and 8 to 10 battalions formed of men of the third levy and volunteers. The cavalry received only an augmentation of 1 or 2 weak squadrons, which with the squadrons previously existing subsequently formed the nucleus of the 3rd Bulgarian Cavalry Regiment. There was no provision for the train in peace-time, and it had to be formed by means of the requisition of country carts under the same difficulties as in Bulgaria. The total strength of the force, including the Ersatz cadres retained in the several garrisons, amounted to about 40,000 men.

At least a half of this force took part in the war with Servia, fighting side by side with the Bulgarians, and acquitting themselves in the same honourable manner.

Immediately after the armistice in December, 1885, the reorganization of the East Roumelian Militia was taken in hand on the same lines as the Bulgarian Army.

According to this they would be organized in infantry regiments of 4 battalions, and form the 5th and 6th brigades of the United Bulgarian Army. The small contingents of the other arms were equally incorporated in it.

Persia.

The events on the borders of Afghanistan have led others besides ourselves and Russia to take a special interest in the Persian military resources, an account of which is given in v. Löbell's publication. Nominally the Persian Army is composed of 70,000 men of all arms ; but as it is maintained or not more or less according to the exigencies of the moment, and is not pro-

vided for by any fixed budget, much dependence cannot be placed upon the estimated numbers.

The force is divided into three local armies in time of peace allotted to the Provinces of Teheran, Ispahan, and Tabriz respectively. The Governors of these provinces are the Commanders-in-Chief of the several armies which are dependent upon them for their organization, armament, and training, the result of which arrangement is that there is no unity whatever in any of these directions.

The total number of infantry battalions is 76, formed into 8 to 10 companies, and they have an effective strength varying from 250 to 1,000 men. The cavalry consists of 2 regiments or 4 squadrons, and one of two squadrons, a squadron forming a body guard to the Shah, each squadron numbering from 50 to 150 horses.

The artillery is composed as follows :—

- 3 field batteries, each of 6 guns.
- 20 battalions of foot artillery, each of 200 men, for the service of 2 batteries of 6 guns.
- 30 mountain guns.
- 200 camel guns, with 400 camels.

One battalion of engineers exists, but the term is purely honorary, for the men composing it have no claim whatever to any technical knowledge.

The Ispahan Army, commanded by the Prince Zil-e-Sultan, is the best organized and trained owing to the energy and intelligence of its commander. It is composed of 4 regiments of infantry, 2 of cavalry, 3 batteries of field and $1\frac{1}{2}$ of mountain artillery. It is recruited partly by means of volunteers, partly by contingents drawn from the several villages of the province. The infantry are formed in companies of 200 men in two ranks, clothed in grey with helmets, and armed with the Werndl rifle and yataghan. The drill is based on the Austrian Drill-book, but the musketry instruction is very insufficient, and there is no training in field work.

The 2 cavalry regiments are composed of 2 squadrons of 150 horses in 4 subdivisions. The men are clothed as the infantry, but with a white felt cap, and armed with the Russian Cossack sword and the Werndl carbine. The horse equipment is Persian and for the most part in bad order. The men are naturally good riders individually, but their instruction as cavalry is only nominal.

The artillery have the Uchatius gun of 7 and 8 cm., the men being armed with sword and Snider carbine, and clothed as the cavalry, from which they are only distinguishable through wearing a dark-coloured cap. Their training is excellent, and 30 rounds per gun are allowed annually for practice.

The weakest point in the army is to be found in the native Officers, who, with the exception of one or two trained abroad, are totally uninstructed in military matters. The natural result is that the discipline is very bad.

The two armies of Teheran and Tabriz can lay no claim to such an organization as that of Ispahan. No attempt is made to obtain any similarity in uniform, training, or armament, and their discipline is still worse. As an instance of the value of these troops an expedition is quoted which was sent to the Atrek in January, 1885, against the Yomuds. The expeditionary force, composed of 2,000 men of whom 1,600 were infantry, was drawn from the Teheran Army. Arms were issued to the infantry only when they were ready to march ; they consisted of 1,200 percussion arms of the oldest construction, and 400 Werndl rifles. Before the force was clear of the environs of Teheran, where it had been reviewed by the Shah, it had dwindled to 1,200 men, and when it reached the Atrek, only 600 remained, the rest having been dismissed by their commanders, though money was drawn for

the original strength of the force for the duration of the expedition. A beginning has been made with the formation of a fleet, and lately 10 Uchatius guns and 4,500 Werndl rifles have been sent to Teheran from Austria.

Roumania.

While keeping aloof from the complications in the Balkan peninsula, the young kingdom has been steadily carrying out the reorganization of its army as contemplated by the law of June, 1882. The infantry is divided into 32 Dorobanzen regiments, varying in strength from nearly 1,500 men to about 300, the larger effective being allotted to frontier regiments, which have to find numerous posts and picquets for the mountain passes and landing stations on the Danube. The permanent cadres are on an average about 180 men; the rest are on furlough, but are called up for a week's duty in every month. The regiments are formed into 4 army corps each of 4 brigades of 2 regiments.

The cavalry consists of 12 Kalaraschen regiments of an effective of about 450 men, and a permanent cadre of 137 men and 74 horses, the arrangement regarding duty being similar to that in the infantry. They are formed into 4 cavalry brigades of 3 regiments.

The artillery is composed of 8 field artillery regiments of 4 batteries and 18 territorial batteries, of which 4 are mountain batteries. The whole have, under the new organization, been formed into 4 artillery brigades.

According to a scheme by General Brialmont, for the defence of Bucharest, which was accepted by the Roumanian Government, the city is to be protected by an *enceinte* of 25 kilometres circumference, and 13 detached posts of three different sizes situated at from 6 to 9 kilometres from the *enceinte*, the enlarged circumference of defence being 60 kilometres. These detached forts are in each case to carry one, and in some two plated circulating turrets, of which 54 in all are required for the defensive works. Four of the forts are in course of construction, viz., those at Chitilla, Magoschoia, Otopeni, and Tumari. The estimated time for the completion of the system is during the year 1890.

The railway system was further developed in 1885 by the opening of the line Piatra-Bacau, 57·8 kilometres in length. A line from Bucharest to Czernavoda was commenced, which will join that from the latter place to Kustendje, and open direct communication between the capital and the Black Sea. Other subsidiary lines were also undertaken.

Russia.

The new organization of the train services in the Russian Army was dealt with generally in the Report for 1884, and has been followed in that for 1885 by a more detailed description of the train which accompanies a Division of infantry and its position on the march.

i. The 1st echelon of the train, answering generally to the German "small baggage," is with the columns of the fighting troops.

Infantry Train.—The regimental train, 1st echelon, follows the 4th battalion of each regiment, and consists of 8 small-arm ammunition carts, 1 sanitary wagon, 4 four-horsed ambulances, 6 Officers' carts, and 4 reserve horses. These 23 vehicles and 40 horses, the carts ranged by twos, occupy a space of 150 paces.

Artillery Train.—Assuming that the artillery brigade belonging to the Division is disposed with the 1st heavy battery behind the 1st battalion of the 1st regiment, the 2nd behind the 1st battalion of the 2nd regiment, and the 4 light batteries between the 3rd and 4th infantry regiments, the train would be divided as follows:—

Each of the heavy batteries is followed by 16 ammunition wagons, 1 store wagon, 1 reserve limber, 1 ambulance; each light battery by 12 ammunition wagons, 1 store wagon, and 1 reserve limber. The 1st echelon of the artillery brigade train follows the 4th light battery, and consists of 1 ambulance, 2 medical store carts, 1 sanitary cart, 2 Officers' and 1 Brigade Commander's carts. The 4 light batteries with the train occupy on the line of march 2,150 paces, each heavy battery 600 paces.

The length of the Division with train, viz., 4 infantry regiments and 6 batteries, without allowing for an advanced guard, is 10,850 paces.

Cavalry Train.—The organization of an ordinary infantry Division does not include any cavalry. The 1st echelon of the train for a dragoon regiment follows the 6th squadron, and consists of 6 small-arm ammunition carts, 1 medical store and 1 sanitary cart, 2 ambulances, 6 two-horsed squadron wagons, 40 remounts, 20 mounted men in charge of horses. The squadrons each occupy 180 paces with intervals of 50 paces; the train 192 paces.

ii. The 2nd echelon of the train, answering to the "heavy baggage" of the German Army, follows the fighting troops at an interval of from 500 paces to 8 kilometres.

Divisional sanitary detachment, 40 wagons occupying 300 paces.

„ hospital, 10 wagons occupying 275 paces.

„ Staff, and of the Commander of the 1st brigade, 5 two-horsed wagons occupying 50 paces.

2nd echelon of the 1st regiment occupying 600 paces, and consisting of 16 two-horsed company wagons of the 1st and 2nd battalions; 16 of the 3rd and 4th battalions, 6 regimental wagons and 10 reserve horses, in all 63 vehicles and 111 horses.

2nd echelon of the 1st heavy batteries, 90 paces; 4 batteries and 3 Officers' wagons.

„ 2nd regiment, 600 paces.

„ 2nd heavy battery, 90 paces.

„ 3rd regiment, including transport for the Commander of the 2nd brigade, 615 paces.

„ artillery brigade and the 4 light batteries, 400 paces, viz., 2 carts, 3 two-horsed wagons, and 28 battery wagons.

„ 4th regiment, 600 paces.

The length of the 2nd echelon of the train, viz., 466 vehicles and 887 horses, including intervals, amounts, therefore, to 3,845 paces, and that of the whole Division with the 1st and 2nd echelons of the train, with the prescribed intervals, to 15,195 paces.

The 2nd echelon of the train of a dragoon regiment follows the 1st at an interval of from 500 paces to 8 kilometres, and consists of 6 two-horsed squadron wagons, 17 two-horsed regimental train wagons, 1 veterinary cart, 1 Staff and 1 Commanding Officer's cart, and 8 reserve horses, occupying 306 paces.

iii. The Divisional train, at a distance of 1 day's march.

Sanitary column, a Divisional hospital, 275 paces.

General column consisting of 44 vehicles and 244 horses, comprising the transport of the Divisional train staff, of regiments with the reserve of clothing, intrenching tools, &c., and the reserve of horses, at the rate of 10 per regiment and battery, 700 paces.

Provision column divided into two parts. 1st. The expense transport, composed of 150 wagons and 500 horses, and carrying 4 days' supply for the whole Division,¹ 1,900 paces.

¹ The regimental train carries 1½ days' supply for infantry and artillery, 2½ days' for cavalry and horse artillery, and 5½ for engineers.

2nd Reserve transport consisting of 165 vehicles with 556 horses, carrying provisions for the completion of the expense transport from the nearest magazines, and serving as a transport reserve to the Division for the removal of the sick and wounded. If the Division is able to subsist on supplies furnished by the country, the reserve transport is relegated to the general army train.

Artillery column. When an artillery park, for example a flying park brigade, of 2 infantry and 2 artillery ammunition columns, is attached to the Division.

Engineer column. A portion of an engineer park, which contains intrenching tools and other technical implements for a sapper company and an infantry Division.







Exclusive of the two latter columns and the Divisional hospital, the following are the total numbers of carriages and horses with the Divisional and brigade trains respectively of the units specified :—

| | | | | |
|-----------------------------------|-----|------------|-------|---------|
| An infantry Division | 359 | carriages, | 1,306 | horses. |
| A cavalry " | 73 | " | 240 | " |
| A brigade of rifles..... | 107 | " | 257 | " |







The regimental and Divisional train are organized in such a manner that troops detached from the Division can at once be supplied with the necessary proportion of the train. For example, in the event of the 3rd regiment being detached from the Division, it would be given from the Divisional train; the 3rd section of the general column, of the expense transport, and eventually also the 3rd section of the reserve transport. This can be done without difficulty, for each of the above-named columns is organized in 6 sections, the first 4 for the several infantry regiments, the 5th for the artillery brigade of the Division, and the 6th for the Staff and men of the Divisional train.

It stands to reason that the entire Army cannot be immediately provided with the reorganized train. The new regimental train will be composed generally speaking of one-horsed carts, able to follow the troops wherever wheels can go. Only the ambulances and battery wagons are four-horsed. At the beginning of 1886 the following were already provided with the new regimental train, viz., the whole of the cavalry and artillery, almost all the rifle battalions, and a portion of the infantry Divisions. For these, therefore, it only remains to effect the necessary changes in the Divisional train, which is to be composed mostly of the two-horsed light wagons, pattern 1884, with some carts. For the present, however, until they are used up, the heavier two-horsed wagons, pattern 1876, are to be retained and drawn by three horses.









Disposition of a Russian Infantry Division on the March.











| | | |
|-------|---|--|
| Paces | | |
| 350 |  | I/1. |
| 50 | | |
| 600 |  | 1st heavy battery with train, 1 échelon. |
| 50 | | |
| 350 |  | II/1. |
| 50 | | |
| 350 |  | III/1. |
| 50 | | |
| 350 |  | IV/1. |
| 25 | | |
| 150 |  | Train, 1 échelon of 1st regiment. |

Interval between regiments, 100





| | | |
|-----|---|-----------------------------------|
| 350 |  | I/2. |
| 50 | | |
| 600 |  | 2nd heavy battery, &c. |
| 50 | | |
| 350 |  | II/2. |
| 50 | | |
| 350 |  | III/2. |
| 50 | | |
| 350 |  | IV/2. |
| 25 | | |
| 150 |  | Train, 1 échelon of 2nd regiment. |

Interval between brigades, 100

| | | |
|-------|---|--|
| 1,550 |  | 3rd regiment. |
| 25 | | |
| 150 |  | Train, 1st échelon of 3rd regiment. |
| 100 | | |
| 2,150 |  | Artillery brigade staff, 1st light battery and train, 1 échelon. |
| |  | 2nd ditto. |
| |  | 3rd ditto. |
| |  | 4th ditto. |
| 100 | | |
| 1,550 |  | 4th regiment. |
| 25 | | |
| 150 |  | Train, 1 échelon of 4th regiment. |
| 500 | | to 8 kiloms. |

| | | | |
|----------------------|-----|---|--|
| 2nd échelon of train | 300 |  | Divisional ambulance. |
| | 25 | | |
| | 275 |  | „ hospital. |
| | 25 | | |
| | 50 |  | Train of divisional staff, and commander 1 |
| | 25 | | brigade. |
| | 600 |  | „ 1st regiment. |
| | 25 | | |
| | 90 |  | „ 1st heavy battery. |
| | 25 | | |
| | 600 |  | „ 2nd regiment. |
| | 25 | | |
| | 90 |  | „ 2nd heavy battery. |
| | 25 | | |
| | 615 |  | „ 3rd regiment. |
| | 25 | | |
| | 400 |  | „ staff of artillery brigade and 4 light |
| | 25 | | batteries. |
| | 600 |  | „ 4th regiment. |

At an interval of a day's march.

| | | | |
|------------------|-------|--|---|
| Divisional train | 275 |  | 1 Divisional hospital. |
| | 25 | | |
| | 700 |  | Staff of Divisional train and general column. |
| | 25 | | |
| | 1,900 |  | Expense transport. |
| | 25 | | |
| | 2,100 |  | Reserve transport. |

When these accompany column—

Artillery park.
Engineer park division.

It has been decided to increase the number of subaltern Officers in the infantry on a peace footing by 7 per regiment, and in the rifle battalions by 2 per battalion, which will greatly decrease the difficulty experienced on mobilization of obtaining sufficient trained Officers. The total number of Officers on a peace footing will henceforth be 70 per regiment and 19 per rifle battalion, and on a war footing 79 per regiment and 21 per battalion, so that an increase of only 3 per battalion in the infantry and 2 in the rifles will be required to complete them. At the beginning of the year the Guard regiments, those of the 6th Army Corps, and the rifle battalions had already been completed to the new establishment. The formation of two new battalions, the 7th and 8th, to the Transcaspian Rifles was ordered in the autumn of 1885, and effected by the transfer of complete companies from the infantry Divisions of the Charkoff and Moscow districts.

There have been various changes in regard to several branches of the artillery. Three new foot mountain batteries of 4 guns were formed in Kieff, and placed under the command of the garrison artillery there. On mobilization these would be formed into 6 mountain batteries of 8 guns. The whole of the necessary material for this is kept ready on the spot in peace-time. The Turkestan mounted mountain battery which formerly had 8 guns has been reduced to 6 guns. A new garrison artillery battalion has been formed at Novo-Georgijevsk and Brest-Litovsk, and 2 at Ivangorod, bringing the total number up to 48. In addition to this, the 2nd and 3rd battalions at Düna-berg and the 3rd battalion at Warsaw have each been increased by a 4th company.

New formations have been created in five of the larger fortresses with a view to providing special batteries for sortie purposes in case of siege. The garrisons and both the immediate and eventual formations are given in the following table :—

| Garrison. | Number of the battery in peace. | Number of guns in peace. | Number and designation of the sortie batteries in time of war. | Number of guns and ammunition wagons per battery. | |
|-------------------|---------------------------------|--------------------------|--|---|---------|
| | | | | Ammunition | |
| | | | | Guns. | wagons. |
| Warsaw | No. 1 | 2 | 4 (Nos. 1 to 4 Warsaw) | 8 | 2 |
| N.-Georgijevsk | „ 2 | 2 | 4 (Nos. 1 to 4 N.-Georgijevsk) | 8 | 2 |
| Brest-Litovsk | „ 3 | 2 | 3 (Nos. 1 to 3 Brest-Litovsk) | 8 | 2 |
| Ivangorod | „ 4 | 2 | 2 (Nos. 1 to 2 Ivangorod) | 8 | 2 |
| Kovno | „ 5 | 2 | 3 (Nos. 1 to 3 Kovno) | 8 | 2 |

Alterations have also been made in the disposition of the Ersatz artillery. The 5th and 6th batteries of the 2nd Reserve Artillery Brigade have been converted into a 1st and 2nd Ersatz foot battery of 2 light guns, and 2 light and 2 horse artillery guns respectively. These are temporarily placed under the commander of the garrison artillery at Düna-berg, and form on mobilization 8 independent Ersatz batteries. They are intended to be distributed immediately in rear of the operating army, and to provide for the actual completion of the batteries in the first line in men and horses. This arrangement does not interfere in any way with the total number of the Ersatz batteries, but is only intended to give effect to a new and practical manner of completing the batteries in the first line.

Whereas hitherto each of the 48 Ersatz batteries distributed throughout Russia had to provide for the completion of the corresponding 48 active artillery brigades, this is now done through the intermediary of the 8 new batteries.

Of the total 48 Ersatz batteries, 40 are formed from the 5th and 6th batteries of the 5 reserve foot artillery brigades, and form 5 Ersatz artillery brigades. Each of these brigades has 8 batteries (Nos. 1 to 8), of which 37 are light and 3 mountain batteries. Each battery has 4 horsed and 4 unhorsed guns. The 8th batteries have 4 light and 2 horse artillery guns.

Of the 8 independent batteries which complete the 48, the 1st to 7th have 4 light guns, the 8th 4 light and 2 horse artillery guns.

In the field the 40 batteries of the Ersatz brigades in rear feed the 8 independent batteries, which in their turn complete the 1st line.

The following table shows the disposition of the entire field artillery, including the newly-formed batteries on a war footing.

| Distribution. | Number of batteries. | | | | | Number of guns. | | | | |
|--|----------------------|--------|---------------------|-----------|--------|-----------------|--------|---------------------|-----------|--------|
| | Heavy. | Light. | Horse artillery. | Mountain. | Total. | Heavy. | Light. | Horse artillery. | Mountain. | Total. |
| I. <i>Field Artillery</i> — | | | | | | | | | | |
| 1. <i>Foot Artillery.</i> | | | | | | | | | | |
| 3 Guard artillery brigades | 6 | 12 | .. | .. | 18 | 24 | 48 | .. | .. | — |
| 4 Grenadier " | 8 | 16 | .. | .. | 24 | 32 | 64 | .. | .. | — |
| 41 Army " | 82 | 152 | .. | 12 | 246 | 344 | 628 | .. | 68 | 144 |
| 1 Turkestan " | 2 | 3 | .. | 2 | 7 | 12 | 24 | .. | 16 | 16 |
| 1 W. Siberia " | .. | 3 | .. | 1 | 4 | .. | 24 | .. | 8 | 24 |
| 1 E. Siberia " | .. | 1 | .. | 3 | 4 | .. | 8 | .. | 24 | 96 |
| Foot mountain batteries in Kieff | .. | .. | .. | 3 | 3 | .. | .. | .. | 12 | 24 |
| Total foot artillery | 98 | 187 | .. | 21 | 306 | 412 | 796 | .. | 128 | 304 |
| 2. <i>Horse Artillery.</i> | | | | | | | | | | |
| 1 Guard horse art. brigade (including | .. | .. | 6 | .. | 6 | .. | .. | 36 | .. | 36 |
| Guard Don Cossack battery) | .. | .. | 23 | .. | 23 | .. | .. | 138 | .. | 138 |
| 28 Army artillery brigades | .. | .. | 21 | .. | 21 | .. | .. | 126 | .. | 126 |
| Army Don Cossack horse art. brigade.. | .. | .. | 5 | .. | 5 | .. | .. | 30 | .. | 30 |
| 5 Kuban " | .. | .. | 2 | .. | 2 | .. | .. | 12 | .. | 12 |
| 2 Terek " | .. | .. | 6 | .. | 6 | .. | .. | 36 | .. | 36 |
| Orenburg " | .. | .. | 3 | .. | 3 | .. | .. | 18 | .. | 18 |
| Transbaikal " | .. | .. | .. | 1 | 1 | .. | .. | .. | 6 | 6 |
| 1 Turkestan horse mountain battery .. | .. | .. | .. | 1 | 1 | .. | .. | .. | 8 | 8 |
| 1 W. Siberian " | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. |
| Total horse artillery | .. | .. | 66 | 2 | 68 | .. | .. | 396 | 14 | 410 |
| II. <i>Sortie Artillery</i> — | | | | | | | | | | |
| Sortie batteries | .. | 16 | .. | .. | 16 | .. | 128 | .. | .. | 128 |

| Distribution. | Number of batteries. | | | | | Number of guns. | | | | |
|--|----------------------|--------|---------------------|-----------|--------|-----------------|--------|---------------------|-----------|--------|
| | Heavy. | Light. | Horse artillery. | Mountain. | Total. | Heavy. | Light. | Horse artillery. | Mountain. | Total. |
| III. <i>Reserve Artillery</i> — | | | | | | | | | | |
| 20 Reserve foot artillery brigades | 20 | 60 | .. | .. | 80 | 160 | 480 | .. | .. | 640 |
| IV. <i>Ersatz Artillery</i> — | | | | | | | | | | |
| Independent Ersatz batteries | .. | 8 | .. | .. | 8 | .. | 32 | 2 | .. | 34 |
| 5 Ersatz artillery brigades | .. | 37 | .. | 3 | 40 | .. | 148 | 10 | 12 | 170 |
| 1 Don Cossack " | .. | .. | 1 | .. | 2 | .. | .. | 4 | .. | 4 |
| 1 Orenburg " | .. | .. | 1 | .. | 2 | .. | .. | 4 | .. | 4 |
| Total Ersatz artillery | .. | 45 | 2 | 3 | 50 | .. | 180 | 20 | 12 | 212 |
| VI. <i>Instructional Artillery</i> — | | | | | | | | | | |
| 1 Instructional foot battery | .. | 1 | .. | .. | 1 | .. | 8 | .. | .. | 8 |
| 1 Instructional horse art. battery | .. | .. | 1 | .. | 1 | .. | .. | 6 | .. | 6 |
| Total instructional artillery | .. | 1 | 1 | .. | 2 | .. | 8 | 6 | .. | 14 |
| Grand total | 118 | 309 | 69 | 29 | 525 | 944 | 2,292 | 422 | 218 | 3,876 |

Servia.

The mobilization of last September extended to the whole of the 1st levy and a portion of the 2nd, but as a matter of fact the former was not completed on a war footing. In accordance with the scheme in force the 1st levy, which includes the ten yearly classes aged from 20 to 30, together with the Ersatz formations, should form on mobilization 20 infantry regiments (including 5 Guard regiments) of 4 battalions; 5 cavalry regiments of 4 squadrons; 5 artillery regiments of 8 batteries (6 guns), and 5 pioneer companies, the whole formed in 5 divisions; and in addition 1 guard squadron, 1 mountain artillery regiment of 6 batteries (of 4 guns); 1 garrison artillery battalion of 4 companies and 2 pioneer companies under the direct orders of the Commander-in-Chief of the Army. The effect of the mobilization, however, was restricted to the completion of the 15 line regiments to 3 battalions only, of the 5 cavalry regiments to 3 squadrons, and the 5 artillery regiments to 4 batteries, while of the Guard battalions only 4 were brought up to a war strength, and the 3 mountain batteries already existing were not increased.

The result of this partial mobilization of the 1st levy was to put into the field a force consisting of 49 battalions, 16 squadrons, and 23 batteries, and numbering in round numbers 55,000 men, or about 41,000 combatants, 1,600 cavalry, and 132 guns.

The 2nd levy, including the seven yearly classes from 31 to 37 years of age, is estimated to form 60 battalions, 10 squadrons, 20 mountain batteries, and 5 pioneer companies. Of these, only 5 infantry regiments and 2 squadrons were at first formed and 2 more regiments later on. Reckoning these regiments of the 2nd levy at 3 battalions, the whole of the Servian forces in the first line were composed of 70 battalions, 18 squadrons, and 23 batteries, amounting to a fighting strength of 53,000 men, 1,800 horses, and 132 guns.

The incomplete and unsatisfactory result of the mobilization was due to several causes. The existing organization was of comparatively recent date, the cadres had been fixed at far too small a strength, there was great difficulty in obtaining the number of horses which were required, and lastly money was not easily forthcoming. But in addition to these difficulties, it was never contemplated that the resistance of Bulgaria would be of such a nature as to call for any serious effort on the part of Servia.

The want of Officers and non-commissioned officers consequent on the weak effective of the permanent cadres was severely felt. Notwithstanding that an addition was made to these of five battalions in 1885, the total strength of the cadres did not exceed one-fourth of the estimated war strength of the 1st levy. This proportion could not possibly admit of the necessary number of Officers and non-commissioned officers for the new formations, and the want of them was felt the more that the training of those forthcoming was far from satisfactory.

For the 2nd levy no permanent cadres are maintained, and consequently even greater difficulties were experienced in its mobilization, and such Officers and non-commissioned officers as were allotted to it could only be obtained at the expense of the 1st levy. In order to meet in some degree the want of Officers, the senior classes in the Military Academy were drafted into the Army. The difficulty of obtaining the required number of horses was increased by the decision only to buy them in the country.

As regards the embodiment of the men the mobilization was effected with great rapidity. The order was issued on the 24th September, the first of the reserves came up as early as the 26th, and on the 1st October the concentration of the Army was commenced. This was effected principally by rail, and by the 11th October it was generally speaking completed and the fighting troops were in position; but the train was not ready.

The armament and equipment of the Army was in many respects unsatisfactory. The infantry was armed with the Mauser-Koka rifle, and the cavalry with excellent repeating carbines. On the other hand the field artillery was mostly furnished with the La Hitte gun, an arm not equal to the present requirements; four batteries only had Krupp guns, previously captured from the Turks, and of these some were defective from use. The ammunition forthcoming was lamentably insufficient, only from 3 to 4 million cartridges being available for the infantry. The ammunition for artillery was also wanting, and at Pirot the batteries fell short of shell.

The defeat of the Servian troops is in part to be attributed to the incomplete training of the men. By the Recruiting Law of 1883 those liable to service are divided into three categories, of which the 1st class have to serve two years with the colours, the 2nd class five months, and the 3rd class only one month, consequently the training was unequal, and for a large proportion quite useless. But beyond this, owing to financial considerations, the permanent strength was reduced from 20,000 to 12,000, and the efficiency of the men was still further reduced.

The result of this state of affairs was that when the troops came into action it was found impossible to keep the firing in hand. Some of the troops opened fire at a range of 3,000 metres, and could not be stopped until all their cartridges were expended. At close ranges again they could not be restricted to firing volleys, but fell into an irregular independent firing. Their outpost duty was very defectively performed, and they could not be brought to stand against the bayonet attack of the Bulgarian troops at close quarters.

The small result obtained by the Servian field artillery was attributable in part to its defective material, but partly also to the manner in which it was handled. Fire was generally opened at so great a distance that the projectiles did not reach the enemy's troops, and during the course of the actions the artillery fell into the mistake of directing its attention to the opposing guns, and thus facilitated the advance of the Bulgarian infantry.

The defective organization of the train and the want of administrative ability on the part of the Intendance further contributed to the unsuccessful result of the campaign. During the advance the columns did not manage to keep up with the troops, and the latter suffered severely, whole divisions being left days without the issue of provisions. The same delay was experienced in bringing up the ammunition columns, and the deficiency in ammunition was in part attributable to this.

When the Servian advance came to a standstill at Slivnitza, the complete mobilization of the 2nd levy was proceeded with, which produced an addition to the Army of from 35,000 to 40,000 men.

Turkey.

The Turkish Army consists of 13 army corps, of which the first 12 are formed two from each of the six Provinces (Ordu). The headquarters of these army corps are, 1st and 2nd, Constantinople; 3rd, Adrianople; 4th, Salonica; 5th and 9th, Kossovo; 6th, Monastir; 7th, Erzeroum; 8th, Erzinghan; 10th, Damascus; 11th, Mossul; and 12th, Bagdad. The 9th army corps is recruited from Syria, but has its headquarters in Albania, and the depôts alone in Syria. The 13th army corps is stationed in Yemen, but is completed from the superfluous Ersatz men of the other 12 army corps. The Candia brigade has its own special organization.

Obligatory service is universal for the Mahomedans, but Christians may buy themselves off. The term of service commences at the age of 20, and is divided into 7 years with the Active Army (Nizam), of which 4 years in the

Reserve (Ichtiat), 7 years in the Landwehr (Redif), and 6 years in the Landsturm (Mustafiz).

The state of the Turkish Army at the commencement of 1885 was 264 infantry battalions, 189 squadrons of cavalry, 104 field batteries, 36 mountain batteries, 8 garrison artillery battalions, 19 engineer companies, 5 infantry train battalions, 1 field telegraph company, besides artificer formations. The strength of the force amounted to 9,815 Officers, 149,144 men, 22,025 horses, and 3,202 field and fortress guns.

The 264 infantry battalions were formed into 63 regiments of 4 battalions, except 1 with 5 and 4 with 3 battalions. The peace establishment was 500 men per battalion, but some had 600 men, and some as few as 200.

The cavalry formed 38 regiments, all of 5 squadrons, except 1 which had only 4. The strongest squadrons had 120 men and 70 horses, but many had hardly any horses at all. The establishment was 125 men and horses.

The field artillery numbered 8 regiments, generally of 12 field and 2 mountain batteries, but some had more, and others much less. On an average each battery had 6 guns, all Krupps.

The distribution of the rationed strength of these formations was as follows:—

| Distribution. | Men. | Horses. | Guns. | | |
|--|---------|---------|--------|-----------|-----------|
| | | | Field. | Mountain. | Fortress. |
| 1 Corps at Constantinople and Smyrna..... | 22,258 | 2,658 | 96 | 16 | 314 |
| Tophané troops under the Inspector-General of Artillery..... | 12,052 | 638 | 48 | 6 | 827 |
| 2 Corps at Adrianople..... | 9,246 | 2,039 | 36 | — | — |
| 3 „ at Monastir and Dibre.... | 7,105 | 1,847 | 48 | 16 | — |
| Kosovo Corps..... | 12,071 | 2,572 | 52 | 18 | 80 |
| Scutari Division..... | 4,505 | 301 | 18 | 6 | 57 |
| Janina „..... | 4,274 | 385 | 6 | 12 | 191 |
| Naslitsch „..... | 5,971 | 1,164 | 6 | 12 | — |
| Salonica „..... | 5,867 | 1,471 | 12 | 6 | 82 |
| 4th Army Corps..... | 21,282 | 3,510 | 120 | 36 | 350 |
| 5th „ „ in 5th Ordu District..... | 12,701 | 1,270 | 72 | 18 | 110 |
| 6th Army Corps..... | 12,602 | 2,938 | 60 | 10 | — |
| 7th „ „..... | 13,326 | 631 | 18 | 20 | 78 |
| Mecca Division..... | 2,827 | 116 | .. | 6 | 57 |
| Crete „..... | 4,582 | 563 | 12 | 24 | 99 |
| Tripoli „..... | 8,290 | 922 | 18 | — | 129 |
| Total..... | 158,959 | 23,025 | 622 | 206 | 2,374 |

In April, 1885, the threatened hostilities between England and Russia led to the Porte taking steps to maintain the neutrality of the Dardanelles and the Bosphorus. Acting on the Report of the Commissions, composed of Turkish Officers and German Officers in the Turkish service, the old fort on the southern entrance of the Dardanelles on the Asiatic side, called the Korum-Kaleh-si, was repaired and armed with 7 heavy Krupp guns, some of the uncompleted high-level batteries were finished, and the inner line of obstructive mines at Chanak-Kaleh-si renewed and protected by mitrailleuse

batteries on either shore. The telegraphic communication between the several defences of the Straits, which was generally defective and in some instances altogether wanting, was completed and placed in an effective condition. The high-level batteries were armed with 60 Krupp mortars. The works on the Bosphorus were restricted to the construction of two high-level batteries. The armaments were increased by the following guns, all from Krupp :—

7 80-ton coast guns.
22 of 24 cm. "
430 field guns.

In September, 1885, the outbreak of the East Roumelian province led to the mobilization of the Turkish Army. The result of this at the beginning of March, 1886, was the following :—

Mobile Troops.

| | Battalions. | Squadrons. | Field batteries. | Mountain batteries. |
|--|-------------|------------|------------------|---------------------|
| In Europe and Candia— | | | | |
| Nizam | 106 | 74 | 63 | 26 |
| Redif I | 128 | — | — | — |
| " II | 96 | — | — | — |
| Redif battalions formed from excess in num- bers required as above | 20 | — | — | — |
| In Asia— | | | | |
| Nizam | 53 | 59 | 24 | 5 |
| Redif I | 10 | — | — | — |
| Redif II | 42 | — | — | — |
| Total | 455 | 133 | 87 | 31 |

Immobile Troops.

| | | | | |
|------------------------|------|----|----|----|
| Constantinople..... | } 23 | 23 | 22 | 3 |
| In Europe..... | | | | |
| Asia and Tripoli | | | | |
| Total | 111 | 63 | 40 | 10 |

The total rationed strength of the whole of the above troops amounted to about 475,000 men.

The mobile portion of this force was distributed as follows :—

1st. *The Adrianople Army*, under Muschir Tâhir Pasha, composed of 5 divisions with 80 battalions (24 Nizam, 56 Redif), 20 squadrons, 14 field and 4 mountain batteries ; or about 56,000 infantry, 2,600 cavalry, 84 field and 25 mountain guns.

2nd. *The Army of Macedonia and Albania*, under Muschir Weissel Pasha, 6 Divisions, consisting of 109 battalions, 22 squadrons, 22 field and 12 mountain batteries ; or about 76,000 infantry, 3,080 cavalry, 132 field and 72 mountain guns.

3rd. *The Army on the Greek Frontier*, under Muschir Achmed Eyoub Pasha, having a strength of 9 Divisions, with 136 battalions, 30 squadrons, 26 field and 6 mountain batteries, numbering 95,200 infantry, 4,200 cavalry, 156 field and 36 mountain guns.

4th. *The Force on the Montenegrin Frontier*, of 10 battalions, under Muschir Mustapha Assim.

5th. *The Force in Candia*, 15 battalions (8 Nizam, 7 Redif), 2 squadrons,

1 field and 4 mountain batteries; about 10,500 infantry, 280 cavalry, 6 field and 24 mountain batteries, under Savas Pasha.

The numbers rationed with the mobilized armies in the Balkan Peninsula and in Candia amounted to 317,600 men.

The manner in which the mobilization was carried out was generally very satisfactory, and showed marked progress over that of the preceding year. Although the Turkish organization cannot boast of any minute preparation during peace-time for eventual mobilization, the machinery, such as it was, worked smoothly and the men came in rapidly. The embodiment of the Redif formations was carried out with extraordinary rapidity, considering the generally slow movements of the Turkish administration. The first battalions on the Asiatic coast were formed in the prescribed strength, and ready to march in from seven to ten days. The prompt transport of the Asiatic Redif formations to the points of concentration in the Balkan Peninsula was no less remarkable. The first embarkation was made on the 6th October, and by the 31st of that month 90 battalions had been landed on the European coast.

In some districts the men came in in such numbers that an extra battalion was formed. Only in Macedonia and Albania was there any serious deficiency in the numbers that came up. As regards the efficiency of the Redif, the result was not so favourable, for it appears from the official lists, that of the 266,000 1st class and 257,000 2nd class, only about 113,000 of each had received any military training.

The establishments of the several units was fixed at 700 rifles for the infantry battalions, 140 horses per squadron, and 6 guns per battery, which were completed early in 1886, while many of the Redif battalions were considerably over their establishment.

As regards the armament of the troops, the infantry were all armed with the Henry-Martini rifle, for which an abundant supply of ammunition was available. At the commencement of the mobilization the guns ordered from Krupp had not been delivered, and the newly-formed batteries were provided with guns manufactured in the Arsenal.

In March, 150 guns with equipment complete were received from Krupp, and 426, a second instalment ordered in February, had still to be delivered. Horses for the cavalry were for the most part purchased in the country, and those for the artillery abroad. Of the former 5,000 were obtained, mostly from Kurdistan, and 4,500 were purchased in Hungary, of which 3,000 for the artillery. The saddlery was obtained through German firms.

The clothing and equipment of the troops was good and almost entirely new, part of the former being obtained from Germany.

The train and sanitary columns were altogether wanting, but the former deficiency was met by allotting 60 mules or ponies to each battalion. The troops were rationed by the occupied provinces, in which the tithe tax was remitted, so as to make up for this.

All the reports regarding the forces agreed in saying that they were in good condition and fit to take the field—though the training of the men left much to be desired. But it must be regarded as a very satisfactory earnest for the future of the Turkish Army, that after an interval of only seven years since an arduous war, Turkey should be a position to place in the field, under her new organization, so formidable a force, superior in every respect to that which she opposed to Russia in 1877–78.

Infantry Tactics.

The development of infantry tactics during the year 1885 followed the course marked out by the experiences derived from the Franco-German and Russo-Turkish campaigns. One of the most important conclusions arrived at

from these experiences is that, opposed to the present infantry fire, an unsuccessful attack means, if not the destruction of the troops, at least their being withdrawn out of the fighting line. A successful attack on open ground is the highest feat of arms of which the infantry soldier is capable, and it requires more than ever, besides energetic execution, a careful methodical preparation. The battles of St. Privat and Plevna proved the necessity for raising the musketry training of the soldier to the same high level as the mechanical excellence of the arm he carries. In the absence of a thorough training in firing, combined with strict fire discipline and careful control of the fire by all subordinate commanders at least up to the battalion commander, troops armed with long-range, rapid-firing rifles will inevitably fall into independent firing at long distances, when all the advantages to be derived from unity of action will be lost. This is the defective point in the new magazine rifle about to be issued to the troops. Even in the hands of such unformed soldiers as the Turks, considerable results were obtained at enormous distances, at which their opponents suffered appreciable losses; but the expenditure in ammunition amounted in several engagements round Plevna to as many as 500 rounds per man. Notwithstanding this wholesale expenditure the Russians captured in the course of the war 500,000,000 cartridges. There is no doubt that it would be simply impossible to carry even a quantity approximately as great for the use of large armies on the move. This being so, the only alternative is to restrict the fire, making up for this by a training which will ensure the utmost possible results being gained by it. This view has been very generally accepted, and the consequence is that all the military States are vying with one another in making practical instruction in fire tactics the most important factor in the soldier's peace training.

Most of the regulations and musketry instructions restrict the employment of rapid fire to distances of from 200 to 400 metres; but it is to be noticed that the new German regulations do not do this. The evils which may result from the employment of this mode of fire at greater distances, such as unsteadiness in the troops and the insufficiency of the results obtained, are dwelt upon; but it is left to the discretion of those in charge of the several units to use it when the special circumstances may appear to them favourable to its employment. The Prussian Guard suffered its greatest loss at St. Privat, at a distance from the enemy of over 500 metres; some regiments even lost most of their Officers at 800 metres distance. The Russians experienced the same at Plevna and Gorni-Dubnik. Only rapid fire at unfavourable objects, under bad leading and with insufficiently trained troops, can be regarded as ammunition thrown away. With well-trained infantry, armed with a rifle with sufficient range, a flat trajectory and good penetration, the distance should in future play a secondary part. Long-range fire, both independent and volley, will be regarded as a fundamental instruction rather than as an occasional practice.

A further question awaiting solution is the employment of indirect fire against an object covered in front to an inconsiderable height only, so as to be able to assist an attack in front by infantry, by means of the fire of special bodies posted outside the sphere of the actual attack, and forming what the French call "*batteries de fusils*." This question can only be finally settled in a future campaign; but there can be no doubt that the army which has been best trained in the application of indirect fire, so far as its development can be effected on theoretical principles alone, will have a considerable advantage when the time comes for its employment in the field.

The actual adoption of a repeating rifle was long deferred, but it is now understood to have been decided on in favour of an arm which, while it has the repeating mechanism entailing considerable extra weight, is lightened by means of a diminution in the bore, having the additional advantage of

reducing the weight of the ammunition. The pattern adopted was issued this year to a large portion of the troops taking part in the autumn manœuvres, and it is pretty certain that its general issue will follow without delay. At the same time a new pattern pack was tried, which has the advantage of increased lightness over the old. This is the more necessary that the possession of a repeating rifle will entail the troops carrying an increased number of cartridges, which could not be done if the soldier were to continue to carry the existing pack, which may be taken on an average to weigh, with other equipment, about 60 lbs.

The new regulations for the drill and exercise of the French Army were completed in 1885 by the publication of Part V, embracing the regiment, brigade, and Division. The probable course of an action in which an isolated Division on the march becomes engaged is given in the concluding chapter. The Division advancing on one road sends an advance guard forward composed of 3 battalions and 1 battery; 2 companies bring up the rear. The Divisional cavalry regiment sends out 3 squadrons to clear the advance and reconnoitre; the 4th squadron provides for the protection of the column on both flanks. During the march the Divisional Commander, Generals, and other Commanding Officers should study the ground with a view to an eventual action, the place of the Divisional Commander being with the advanced guard. Upon coming into contact with the enemy, the cavalry seeks to drive in that opposed to it and to reconnoitre the ground up to the enemy's position. The advanced guard deploys for attack, as ordered by the Divisional Commander, who, with his staff, goes forward to reconnoitre, and gives the Commanding Officers their orders. Salient points of the enemy's position should, with the assistance of the artillery, be first seized, and placed in a state of defence so as to be used as points of support during the further course of the action. The employment of the reserves generally is left to the regimental and brigade commanders, but the regiment in the third line only receives its orders directly from the Divisional Commander. The bodies detached to attack the enemy's flanks should keep their movements masked as long as possible; but as soon as they reach the position most favourable for attack they must carry this out with the utmost energy, supported by the concentrated fire of all the batteries. This moment must be seized by the troops attacking in front to redouble their efforts, so as to prevent the enemy from detaching reinforcements to the flanks.

In the event of the attack succeeding, the regiment of the third line and all the batteries move into the captured position in order to break the last resistance of the enemy and prevent him from taking up position again further back, while the first and second line re-form. The cavalry maintain their touch of the retiring troops and attempt to gain their line of retreat. As soon as the whole infantry have re-formed they follow in energetic pursuit.

Should the attack fail, the cavalry, artillery, and third line, so far as it is not engaged, have to cover the movement in rear, after which a fresh attack can be undertaken after the necessary preparation. If it should be indispensable to give up the attempt altogether, the previously prepared points will be occupied under cover of the cavalry and artillery so as to secure the retreat. The strength and formation of the rear guard during the further retirement must be dependent upon the attitude of the enemy, who must be held at any price, and the ground only evacuated step by step.

Material progress has been made by the French Army during recent years in the use of the rifle, and the question of indirect fire has lately been much debated. The interest shown in the improvement of the soldier's firing has extended beyond the Army, as is demonstrated by the fact that the number of "shooting societies," which at the beginning of 1883 was 232, has in-

creased to 502. The Departments bordering on the German and Belgian frontiers are the most forward in the movement. The competitions are carried out with the Army rifle at ranges of from 200 to 300 m., and all the societies are represented by several members at an annual rifle meeting which takes place at Vincennes.

The question of the adoption of a repeating rifle has not yet been definitely solved in France. The Kropatschek rifle issued to the Marines in 1878 was first put to the test of active service in Tonquin, and in 1884 other infantry regiments there were armed with it. Official reports express satisfaction at the result, which is not echoed by independent critics; "*La France Militaire*," for instance, maintains that the employment of the repeating rifle must infallibly lead to the troops armed with it being forced to adopt the defensive.

However this may be, the trial of new patterns has been uninterrupted, and lately 100 men of each of the 24 rifle regiments have been armed with the Gras rifle converted on the Kropatschek system, which is very favourably reported on.

The training of the troops in field work of every description has been carried out with the greatest zeal and energy, and a novel element introduced by the practice of crossing rivers by swimming. At Blois, 25 men of the 31st Regiment swam across the Loire and back, a breadth of over 100 m., with their arms and ammunition, which were used by the men on the opposite bank. Great importance is given to route march, and a remarkable performance was reported of the 24th Rifle Battalion, which marched 109 kilometres in 36 hours, with complete kits, without a man falling out.

In the Russian Army the most noteworthy point has been the development of the rifle training of the infantry. As an exercise in field firing a report is given of the performances of a force consisting of a battalion at war strength, 8 guns, and 2 sotnias of Cossacks. The 1st company fired 1,248 cartridges at a distance of 1,450 paces at a covered object, and made 10 per cent. hits. The 2nd, 3rd, and 4th companies fired 8,375 cartridges at the same distance at a visible object and made 30 per cent. hits. The issue of ammunition was made by means of a horse carrying 4 cartridge bags, each containing 24 packets, each weighing 35 lbs., and making in all 1,440 rounds. The horse was kept under cover behind the reserve company, and on the order, 4 non-commissioned officers each took a bag and carried it to his company; 15 paces behind the group-leaders he deposited the bag and threw the packets to them.

Similar field-firing, simulating as far as possible the conditions of actual warfare, was carried out by Austrian troops at the Brück camp. The artillery fire being conducted from 3,000 to 1,000 paces, and that of the infantry from 1,400 to 300, the defensive position being marked in part by figure disappearing targets, and shrouded with smoke. A repeating rifle, on the Mannlicher system, which it is proposed to adopt, has been exhaustively tried, and it is claimed for it that it is capable of firing 30 rounds per minute.

A new rifle instruction has been adopted for the Italian infantry, replacing provisional instructions issued last year. Independent firing at single individuals at distances over 400 metres is forbidden; great stress is laid upon rapid aiming, exercise in quick firing, and judging distance, for which prizes are to be given. Independent and volley firing is practised at distances from 300 to 1,600 m. at targets representing skirmishing lines, columns, and guns. There is no regular classification, but 3 non-commissioned officers and 24 men who are the best shots as decided by an annual competition receive prizes and wear badges. National rifle associations were established in each province in 1882, the Government providing arms.

Two important changes have been made in organization, by which the

peace strength of companies was raised from 90 to 100 men, and all infantry Captains are to be mounted.

In Belgium the new field exercise book, commenced in 1884, was completed.

As regards the company, the French formation of line of peloton-columns has been adopted, by which the company is formed into three small columns with half intervals, which is considered handier than the ordinary company columns. With a view to obtaining a closer connection between the skirmishing line and its support, both of these are taken from the same subdivision. The leading half of two of these form the skirmishing line together, and are supported by the other halves in close order at a distance not exceeding 200 m. On the defensive whole subdivisions may form the skirmishing line. Reserves in close order cross open ground under fire by successive rushes of squads or half subdivisions from cover to cover. The extension of front is in no case to exceed the double of the deployed company. Whistles are only to be employed to attract the attention of skirmishers and bugle sounds to prepare for cavalry, to commence independent fire, to cease fire, to charge, and to assemble.

A company not acting independently forms in open ground for attack, at 1,400 m., line of peloton-columns. Scouts are then sent forward on whom the leading half subdivisions form the skirmishing line, the supports and reserve follow. When the supports join the skirmishing line the reserves close to 200 m. from it. Independent fire is commenced at 200 to 300 m. from the enemy; on the signal to advance the line moves forward again by rushes, between each of which a round is fired; the charge follows at 150 m.

A company fighting alone must always combine the front attack with a demonstration against some special point on the enemy's front or flank. On the defensive special bodies are told off for attacks against the attackers' flank.

The rules for the conduct of a company are to be followed, so far as these are applicable, with a battalion. Where this is not acting independently, company-columns will be formed as soon as it comes within the range of rifle fire; in open ground it will be formed in two lines at a distance of about 3,000 m.; the first line, generally the two flank companies, advances about 300 m., halts, and sends out the leading half subdivisions as skirmishers, and forms a fighting line as directed for the company.

The instructions for the formation and conduct of a Division in action resemble very closely the French regulation; but it is somewhat remarkable that they prescribe for the defence the occupation of advanced posts, such as woods and farms, even when at a distance of 800 to 1,200 m. from the front, so as to force a deployment upon the enemy. This is hardly in accordance with past experience, which shows the occupation of isolated posts so far removed from the general line of defence to be a source of weakness, and as they are generally untenable when the deployment of the enemy has been effected, retirement from them tends to demoralize the defenders.

The artillery at the commencement of an action is directed to open fire when possible from favourable positions at about 1,800 m.; but during the last phases of the attack where necessary to approach as near as 700 m. The battalions in reserve have, during the course of the action, to advance gradually nearer to the fighting line. For a Division separately engaged a front of 2,300 m. is prescribed, which may be increased to 3,000 m. in cases where by doing so a support is to be obtained for both flanks.

The Tactics of Field Artillery.

This subject has been exhaustively dealt with in a work by General Kraft, Prince of Hohenlohe-Ingelfingen, in which the following principles are adopted.

In the organization of field artillery it is desirable that 3 artillery regiments should be allotted to each army corps ; 1 regiment of 2 divisions of 3 batteries per infantry division, and the army corps artillery, consisting in peace of 1 regiment of 3 divisions of 3 horse artillery batteries, from which in war the necessary batteries for the cavalry divisions would be detached. The retention separately of the army corps artillery is strongly insisted upon, so as to enable the General commanding to apply it promptly wherever a concentration of guns is required by the situation.

The two most important requirements to ensure the efficiency of the artillery are that it should be highly trained in firing, and be able to make rapid and lengthened marches. As regards its employment every effort must be made to gain from the first a superiority in fire over the enemy's artillery.

The advanced guard of an army corps—one infantry brigade—should be accompanied by one division of artillery, the second remaining with the 2nd infantry brigade. The artillery of an advanced guard marches in rear of the first battalion or regiment of the main body ; that of a division in rear of the first regiment or at least of the first brigade ; the corps artillery behind the first brigade of the main body or at least after the first division.

In action the artillery must avoid all objectless firing, and to do this should approach as near as possible to the enemy. As a rule, however, it must at first be kept out of the reach of shrapnel or at about $3\frac{1}{2}$ kilometres. The decisive artillery duel will take place at from 2 to $2\frac{1}{2}$ kilometres. In the offensive the artillery cannot approach intact and otherwise unoccupied infantry nearer than 1,500 to 1,600 m. But if the infantry is already kept in check by infantry or artillery, the advance may be made to within 1,000 to 1,100 m. During the decisive action of the infantry it must not hesitate to come to the closest quarters.

On the defensive the normal situation of artillery is 500 m. behind the advanced infantry, when by being placed there the field of fire is not restricted. The artillery must on no account leave these positions unless the order is given for a general retreat.

The changes advocated by Prince Hohenlohe would increase the mobility of the artillery, which is in itself very desirable ; but it would be at the expense of weight of metal, for three-sevenths of the batteries would according to his proposal be horse artillery with a lighter gun than the field batteries.

The question of the organization and employment of horse artillery was considerably discussed in 1885, but without any very definite decision being arrived at. The restriction of the number of guns to be attached to a cavalry division to one battery was advocated, on the ground that the presence of more guns seriously retards the movements of a force, and that the necessity for the employment of artillery with a cavalry division is the exception rather than the rule. Theoretically, the presence of several batteries with their wagons would no doubt be a drag on the movements of the division, but as a matter of fact, where it can go with its own provision train, and ambulances, and the 17 heavy wagons of one battery, it can go with those of three and at approximately the same rate. Where it comes to rapid movement, the train, &c., must in any case be left behind, and the 18 guns with their limbers will travel as fast as six. But even were this not so, it cannot be admitted that one battery is by any means sufficient artillery for the purposes of a cavalry division, and while some authorities have advocated two, others, and amongst them Prince Hohenlohe and General v. Verdy, advocate three.

Fortress Warfare.

There is not much to be recorded for 1885 in connection with this subject. The development of the means of communication by means of pigeons and

balloons was actively prosecuted. France may be said to have always taken the lead in the movement, and satisfactory results had previously been obtained from the employment of a captive balloon in Tonquin, while a further advance was made last year. An *aéronautic* school was established at Grenoble, which, while it was less considerable than that of Meudon, is to serve the purpose of training a section of engineers in the use of the captive balloon for reconnoitring purposes. In regard to communication by means of the pigeon-post, a Decree was issued by the Government providing for the requisition of carrier-pigeons in case of war, and prescribing their being annually registered throughout the country in the same manner as horses and carts.

Italy has also been busy experimenting with captive balloons with very satisfactory results. A balloon detachment has been added to the telegraph division of the 3rd Engineer regiment at Rome. A carrier-pigeon station has been established at Ancona.

In Russia a balloon obtained from the French War Department was used, and a voyage made in it from St. Petersburg to Novgorod; and a trained detachment has been formed on the German pattern attached to the engineers. Balloon stations are to be formed at various points for experimenting and training.

In Italy material progress was made with the completion of the system of defensive works adopted, and large sums were voted for their continuation, but not without considerable opposition. The principal works to be undertaken this year were at Spezzia, besides other coast works and forts for the frontier passes.

THE RUSSIAN TRAIN ACCORDING TO THE NEW ORGANIZATION.

By Major-General M. A. HAZENKAMPF.

(Translated from the "Russian Military Magazine" by Captain J. WOLFE MURRAY, R.A., D.A.Q.M.G.)

In order to form a comprehensive idea of the purport of the following article and for facility of reference, the following brief notes as to the organization of the Russian Army are given :—

Infantry.

An Infantry Division consists of 2 brigades, each of 2 regiments : a regiment is composed of 4 battalions (roughly of 1,000 men each) of 4 companies.

Artillery.

To each Infantry Division there is attached a brigade of artillery, consisting of 6 batteries of 8 guns each. Generally speaking, 2 of these are heavy, and 4 are light field batteries.

To each Cavalry Division, 2 horse artillery batteries, of 6 guns each, are attached.

Cavalry.

A Cavalry Division is composed of 2 brigades of 2 regiments each ; the cavalry regiment has 6 squadrons, except in the Cuirassier regiments of the Guards, which have 4 squadrons. The first brigade of each Army Cavalry Division comprises 2 dragoon regiments ; the second brigade 1 dragoon and 1 Cossack regiment. The strength of a 6-squadron regiment may be taken approximately at 1,000 men.

Rifle Brigades.

These consist of brigades of 4 battalions, each battalion 1,000 strong. They are not attached to any particular Division or corps during peace ; but are distributed as required in war.

Engineer Troops.

The following are the principal units :—Sapper battalion, 1,000 men ; pontoon battalion, 594 men ; telegraph park, 250 men ; field engineer park, 200 men. Engineer troops are distributed among the corps as required in war.

Army Corps.

Army Corps consist of two or three Infantry Divisions, with their corresponding artillery brigades (there is no corps artillery), and one Cavalry Division. Engineer troops, &c., are allotted as required.

THE NEW ORGANIZATION OF THE RUSSIAN TRAIN.

The new regulations for the regimental and Divisional train, with their appended tables and establishments, were submitted to the Military Council on the 11th April, 1885, and after receiving the Imperial sanction, were promulgated in General Order No. 188 of 19th July, 1885.

These regulations were worked out by a special Committee on the organization of the troop trains, consisting of Officers of all branches of the Services and of officials of all the departments, selected by the War Minister from those who had taken part in the Russo-Turkish War, under the presidency of Lieutenant-General Baron Zeddeler.¹ Before being submitted to the Military Council, these regulations were repeatedly revised by the various departments at headquarters and in the military districts, and in addition they were considered in some districts by special Committees of representatives of all arms of the Service. The fundamental principles of the projected regulations, as well as the essential outline of the tables and establishments, were at once received with almost unanimous expressions of favour.² Beyond this, a few alterations were required to bring the proposals of the Committee into accord with the changes which were being effected by the Artillery Department, and by the chief Committees on military hospitals and on the organization and training of the troops; this last Committee has since been abolished. Lastly, a few changes were made in accordance with the final instructions of the Military Council on the 11th April.

All this required $3\frac{1}{2}$ years. Meanwhile the technical section of the Committee carried out experiments with new types of vehicles, and in 1884 it finally adopted the new pattern of two-wheeled cart and of two-horsed wagon on Colonel Nikiforov's system.

The essence of the new regulations is as follows:³

The troop trains are divided into *regimental* and *Divisional* trains. The regimental train will carry only the most necessary stores, which the troops cannot possibly do without in action and in bivouac, even when in close contact with the enemy. Everything else is carried in the Divisional train.

I. *Regimental Train.*

Two conditions were taken as the measure by which to determine the nature and quantity of the stores to be carried in the regimental train, viz.: (a) Readiness for action, and (b) the possibility of sparing the troops from useless privations.

In accordance with these conditions, it was laid down in accurate detail for each independent unit what articles and how many of them should be carried in the train, and what the weight of the articles so carried should be. Accordingly all the stores of each independent unit are divided into two categories, viz.:—(1) Those belonging to the company or squadron, and (2) those forming part of the general regimental stores. In order to render the supplying of the troops thoroughly secure in case of the administrative units being broken up into fractions, the regimental train is so organized that each company, squadron, or battery has its own special vehicles; so that when any portion of the regiment is detached, its corresponding portion of the transport is detached with it.

The number of vehicles was calculated upon the quantity and weight of the stores carried, and on the dead weight⁴ of each vehicle, the two together forming the limit of weight.

¹ General Hazenkampf, a well-known authority upon military administration, and Professor of that subject at the Russian Staff Academy, was Secretary to the Committee.—TR.

² Of 60 answers received, 57 were favourable.

³ There are appended to the regulations for the regimental train (1) instructions; (2) list of Officers' baggage; (3) 19 detailed tables and establishments for the train of all staffs and of all independent units. There are special regulations for the Divisional train; and there are appended to them also detailed tables and establishments for the train of all infantry and cavalry Divisions and of rifle brigades.

⁴ The dead weight of each vehicle is thus calculated:—(1.) The weight of the

| | Useful weight. | Dead weight. | Weight of system. |
|--|----------------------|------------------|--------------------------------------|
| | cwts. | cwts. | cwts. |
| 1. For a two-wheeled cart..... | 4 $\frac{1}{4}$ | 6 $\frac{1}{4}$ | 10 $\frac{1}{2}$ |
| 2. For a two-horsed wagon, pattern 1884— | | | |
| (a.) For cavalry and horse artillery | 7 to 7 $\frac{3}{4}$ | 10 $\frac{1}{2}$ | 17 $\frac{1}{2}$ to 18 $\frac{1}{4}$ |
| (b.) For other corps | 8 $\frac{3}{4}$ to 9 | 10 $\frac{1}{2}$ | 19 $\frac{1}{4}$ to 19 $\frac{1}{2}$ |

For well-grown, well-fed, and fresh horses doing harness work in peacetime, this limit of weight may seem to be extremely moderate. But it has been made a *sine quâ non*, because of (1) the want of strength of the majority of the horses which are handed over for the transport service upon the horse conscription, (2) the wear and tear of the service in the transport caused by the irregular times at which the horses are fed, the insufficiency of their food, the injury done to the roads, and the other general severe conditions of warfare. Without a very strict attention to the conditions of the limit of weight, no organization will make the transport mobile.

But even when these conditions are observed, the mobility of the train will not be ensured unless the horses are sufficiently fed. Hitherto our train horses have received the smallest ration (8 $\frac{1}{2}$ lbs. oats and 18 lbs. hay), although their work is very severe, and though in order to bring them up in condition they require abundant feeding. Accordingly, in addition to improving the construction of the vehicles, and in addition to lessening the weight carried in them, it was considered necessary to increase the ration of the train horses from 8 $\frac{1}{2}$ lbs. of oats to 13 $\frac{3}{4}$ lbs., at the same time diminishing the quantity of hay from 18 lbs. to 13 $\frac{1}{2}$ lbs. per day.

Four-horsed and three-horsed vehicles are not admitted in the regimental train as they are exceedingly cumbersome and heavy. But there are the following exceptions to this rule:—(1) Hospital conveyances (*linéika*) in all arms of the Service; (2) Battery wagons of a special type, one per battery; and (3) Vehicles of the engineer train which—with the object of combining, in the most advantageous possible manner, mobility and capacity, and also with a view to diminishing their number—are drawn partly by teams of four horses, and partly by three-horse teams. These exceptions were determined on beforehand by the special departments, and were thus adopted by the Committee for the organization of the train.

To ensure the correct performance of the duties and for the maintenance of strict discipline, responsible Commanding Officers are appointed to the train of each independent unit as a whole, each section also being under a responsible head; the sphere of the duties and responsibilities of each being

vehicle itself with all its appurtenances, and the tarpaulin. (2.) Oats for three days, at the rate of 13 $\frac{3}{4}$ lbs. per horse per day, and hay for two days, at 13 $\frac{1}{2}$ lbs. per horse per day, for the draught horses. (3.) Spare shoes and nails, and horse gear. (4.) Weight of driver and of his kit (180 lbs., including 27 lbs. for kit). In addition to the above the general dead weight of the train of each independent unit, consisting of spare wheels, poles, naves, swingletrees, according to the particular scale, and the picketing gear. This general dead weight is placed upon those vehicles which are not loaded up to the normal limit. Its weight is different for the different units, depending upon the total number of the vehicles. Thus, for instance, in an infantry regiment it is nearly 14 $\frac{1}{2}$ cwt., in a cavalry regiment 8 $\frac{3}{4}$ cwt., in a rifle battalion about 5 $\frac{1}{4}$ cwt. Compared with the former state of affairs, the quantity of spare articles has been diminished by nearly one-half.

accurately defined. In order to develop the training in peace, a programme of instruction for the rank and file of the train has been drawn up, and a system of inspection has been established; exercises in the train service, to be practised at the summer manœuvres, have also been sketched out.

The order of march, the method of bivouacking and of taking up quarters, the disposal and duties of the train during action, have all been accurately defined by special instructions. The train is divided into two categories¹ for purposes of movement when in the proximity of the enemy.

Before setting forth the details of the organization of our regimental train, it is to be noted that important divergencies from the general principles have been permitted in the case of the engineer troops. They have no brigade (corresponding to the Divisional) train whatever; in their battalion (or park) train they carry everything which, in other branches of the Service, is distributed between the regimental and Divisional trains. This exception is caused by the peculiarities of the engineer service: as it is found that the engineer troops are frequently, and for long periods (sometimes for the whole campaign), split up into small fractions, and are scattered over the whole theatre of war. While securing the supply of the engineer troops in such cases, these exceptions are by no means a hindrance to the mobility of the train; for the commanders of corps, of Divisions, of independent columns, or of detachments have the power, in case of necessity, to detach from the engineer train, and to attach to the Divisional train, those vehicles which contain such stores as are carried in the Divisional train in other branches of the Service.

Nature of Stores Carried in the Regimental Train.

The following are to be carried in the regimental train:—(1) Small-arm ammunition; (2) Provisions; (3) Camp kettles, cooking vessels and appliances; (4) Officers' baggage; (5) Treasury; (6) Office stores; (7) Church stores; (8) Medical stores for giving first aid to sick and wounded and for the establishment of dressing stations; (9) Veterinary stores; (10) Tools and materials for shoeing horses, for repair of arms, of boots, of vehicles, and of harness; (11) Spare stores and train appliances.

In the special branches of the Service there are carried in addition—

In the Artillery.—Artillery stores, spare stores and tools, and one-and-a-half day's rations of oats for the gun, ammunition wagon, and riding horses.

In the Engineers.—Intrenching and other tools, appliances for constructing passages of rivers, and for mines, telegraph stores, &c.

In the Cavalry.—(1) Appliances, (*a*) for pack transport, (*b*) for swimming across rivers (bladders); (2) Pack-saddles with tools and materials, (*a*) for destroying railways and telegraphs, (*b*) for constructing bridges and ferries; (3) Intrenching tools.

(1.) *Small-arm Ammunition.*—The number of rounds to be carried for each armed man in the ranks is laid down at 48 in the infantry, 36 in the cavalry, and 23 in the engineers. The ammunition will be carried in special two-wheeled carts, the number of which is calculated at two per company² in the infantry, and at one per company or squadron in the engineers or cavalry respectively. In the infantry half of the small-arm ammunition carts, and in the other troops all the carts, belong to the company or squadron train; the remaining half of the carts in the infantry form part of the general regimental (or battalion) reserve.

¹ Hitherto the regimental train has been divided into three categories. Now that a Divisional train has been formed it will form the third category.

² With regard to infantry regiments this is not quite correct, as there are 33 two-wheeled carts in all, that is 2 per company and 1 additional.

(2.) *Provisions*.—The regulation quantity to be carried is as follows :—

| | Infantry and field artillery. | Cavalry and horse artillery. | Engineer troops. |
|---|-------------------------------------|------------------------------------|---------------------------|
| 1. Biscuits, at 1·8 lbs. per man per day. | for 1½ days. ¹ | for 2½ days. | for 5½ days. ¹ |
| 2. Groats, at 4·8 oz. per man per day... | „ 3 „ | „ 2 „ | „ 6 „ |
| 3. Salt : | | | |
| (a.) For cooking, at 0·9 oz. per man per day..... | „ 4 „ | „ 4 „ | „ 8 „ |
| (b.) For eating, at 0·75 oz. per man per day..... | „ 2 „ | „ 2 „ | „ 4 „ |
| 4. Tea, at 0·225 oz. per man per day... | „ 4 „ | „ 2 „ | „ 8 „ |
| 5. Sugar, at 0·45 oz. „ „ ... | „ 4 „ | „ 2 „ | „ 8 „ |
| 6. Preserved provisions | nil | „ 1 „ | nil |
| 7. Various eatables, at the discretion of the Officer commanding; weight per company or battery not to exceed..... | 72 lbs. | .. | 81 lbs. |

Beef is not to be carried, as this is only possible in cold weather ; otherwise it gets fly-blown and goes bad very quickly. Thus it is not worth while to maintain *special vehicles* in case of its being possible to carry beef ; this would increase the train and the expense of maintaining it, and consequently the cost of the beef also. It is much more practical to allow a reserve of live store cattle to be with the troops in such numbers as circumstances render possible or advantageous. Driving live cattle costs nothing ; the cattle can always arrive in time at the bivouac, and ordinarily the length of the column is not increased thereby, as they are driven alongside of the roads.

But cavalry and horse artillery, from the character of their operations and the rapidity of their movements, can hardly reckon on being able often to have live cattle with them. Accordingly, one day's rations of preserved provisions is laid down for them.

The whole quantity of the supplies of provisions is calculated by weight for the number of men on the establishment, taking into account the weight of bags and simple packing material. The provisions are packed in the company, squadron, or battery vehicles. In the general regimental vehicles, provisions are only carried for the rank and file of the regimental staff.

All Officers are allowed in war a free regulation soldier's ration of biscuit, groats, and salt.

(3.) Camp kettles, cooking vessels, and utensils for cooking hot meals are thus carried ; in the infantry, field artillery, and engineers, large camp kettles at the rate of three per company and battery ; in the cavalry and horse artillery section kettles of a lighter pattern at the rate of four per squadron or battery. The most necessary cooking appliances are carried with the camp kettles. All this weighs rather more than 2¼ cwt. per company and field

¹ This includes half a day (*i.e.*, 0·9 lb. per man) out of the 3 days of reserve provisions which the man carries, and which it has been decided to reduce to 2½ days, so as to lessen the weight carried by the soldier. This is the case only in the infantry and engineers ; it does not apply to the whole of the artillery or to the cavalry.

battery, and nearly 1 cwt. per squadron and horse artillery battery. One additional pair-horsed vehicle is required for each battalion and for each cavalry regiment specially for the transport of the camp kettles, cooking vessels and utensils, if these are to be carried together.

Thus of course it would be very advantageous and would diminish the train if there were no large pattern camp kettles, and if we could do with the small kettles only, as they do in foreign armies. But on mature consideration it was decided that it would be premature to renounce the large pattern camp kettles at present, as the troops have become too much accustomed to them. We must gradually root out this habit by training in peace, we must insist upon the rank and file habituating themselves to cooking in the small kettles, and Commanding Officers must be convinced that this is both necessary and possible. At present only solitary voices are lifted up against the large camp kettles, while the mass stands up for them might and main. When the majority of Commanding Officers shall have become convinced, by means of experiments in peace, of the possibility of doing without the large camp kettles, then only will the time come to do away with them in the train.

(4.) *Officers' baggage* is subject to the following limits of weight: Officers below field rank 108 lbs., Field Officers 126 lbs.

The baggage must be in canvas bags and in trunks of the regulation pattern, on Diterich's system, fitted both for transport in the vehicles and on pack saddles. The limit of weight includes a folding bedstead of the ordinary pattern. In addition to the 108 or 126 lbs. for each Officer there is further laid down (a) for every two Field and other Officers one field tent, and (b) for every *infantry* Officer, required to be mounted by regulation, transport for two days' supply of oats and one day's supply of hay for one horse. In the artillery the supply of oats and hay for the Officers' horses is in the general battery reserve, and in the cavalry no forage whatever is carried in the train (but only on the saddle of each mounted man), as it is impossible to carry it for the whole mass of the horses.

Commanding Officers of regiments and other independent units are allowed 3·84 cwt. of baggage, which includes a tent and forage.

A portion of the Officers' baggage is carried in special two-wheeled carts in the train of the 1st line, and in the cavalry and horse artillery on pack saddles on the led riding horses. The greater portion, however, is carried with the Government stores of their companies, squadrons, or batteries in the train of the 2nd line. The baggage of Officers of the regimental staff is in the general regimental train (2nd line). Commanding Officers of artillery brigades and independent battalions have each their own special two-wheeled cart. Officers commanding batteries have no special two-wheeled carts, but in the matter of baggage they are placed on the same footing as Officers commanding regiments, being allowed 3·84 cwt.

(5.) *Treasury*.—The weight of the treasury and its chest is fixed according to the amount of money required for the interior economy of the body, viz. :—

| | Total weight with chest. | Weight of money. |
|---------------------------------|-----------------------------|------------------|
| For an infantry regiment | 3½ cwt. | 2½ to 3 cwt. |
| For an independent battalion... | 2 „ | 1¼ to 1½ „ |
| For a cavalry regiment | 2½ „ | 1¾ to 2 „ |
| For a battery | 1¼ „ | 1 „ |

The hundredweight includes about 39,062 roubles in gold and 2,344 roubles in silver. Hence it may be concluded that the above normal limit is sufficient even when the whole of the treasury is in hard cash. The chest for the treasury will be of a new pattern, fitting closely into the body of the vehicle.

(6.) The field office comprises the most necessary regulations, orders, books,

documents, and correspondence connected with the combatant and non-combatant branches, maps of the theatre of war, office appliances, folding furniture, and office tent. Where there are bands the music is carried. All documents, &c., required on a campaign are set forth in the table attached to the general order. Nothing else is taken on a campaign, as the system of correspondence and accounts will be much simplified in war time. Company or squadron offices are never to be taken on a campaign: the Officer commanding should have with him only two documents, viz: (1) A general cash book of any form he pleases, and (2) a nominal roll in which he will enter all casualties.

In consequence of this simplification of correspondence and accounts on a campaign the weight of the field office is limited—

| | | |
|------------------------------------|------------------------------------|------|
| For an infantry regiment..... | to $3\frac{1}{2}$ | cwt. |
| For an independent battalion | to $2\frac{1}{4}$ — $2\frac{3}{4}$ | „ |
| For a cavalry regiment..... | to $3\frac{1}{4}$ | „ |
| For a battery | to $1\frac{1}{2}$ | „ |

This weight includes the weight of the chest of a new pattern, which also will fit closely into the body of the vehicle, and which is divided by a partition into two compartments. In one of these compartments are the correspondence of the combatant branch and the music, and in the other are the correspondence of the non-combatant branch and the office appliances. Each compartment can be opened and closed separately, and that too without taking the box out of the vehicle.

(7.) Church stores are limited to those which are most required for the performance of religious services in the field (thanksgivings, sacrament, and funerals). The limit of weight is 1 cwt., including the weight of the chest. Where there is no priest on the establishment, only the regimental *ikon* is carried. Companies, squadrons, and batteries may have their own *ikons*, but they must not be more than 9 lbs. in weight, and must be of folding form.

(8.) *The medical stores* of each body of troops consists of—

(a.) A field pharmacy.

(b.) Appliances for dressings.

(c.) Surgical instruments.

(d.) Everything requisite for the formation of a receiving lazaret of 16 beds in an infantry regiment, of 6 beds in a cavalry regiment and in an artillery brigade, and of 4 beds in an independent battalion.

(e.) Stretchers at the rate of 2 per company, squadron, or battery.

(f.) Medical comforts for sick and wounded.

Detailed catalogues of the field pharmacy and of the medical stores were drawn up by the Committee in 1882, and were included in the first edition; but, on the question being further worked out, they were excluded as the Chief Military Medical Administration and the Chief Committee on Military Hospitals did not agree with the proposals of the Committee, and took upon themselves the compilation of the catalogues.

The stores of the hospital dressers are carried together with the medical stores. Special pharmacy two-wheeled carts are detailed for the transport of the medical stores, as well as hospital wagons or two-wheeled carts. The sick and wounded are transported in special hospital conveyances (*linéika*).

(9.) *Veterinary Stores*.—Horse medicines, drugs, vessels, stores, and veterinary instruments are carried in a special chest for each unit. The quantity is calculated approximately at a three months' proportion for 2 per cent. of the establishment of horses. In the cavalry the veterinary pharmacy chest will be carried in a special two-wheeled cart; in other units it will be carried

together with the general regimental stores. Its greatest weight, in a cavalry regiment, is about $3\frac{3}{4}$ cwt.; its least weight, in a rifle battalion, is about $\frac{3}{4}$ cwt.

(10.) *Tools and Materials.*—For infantry there are carried in the train—

- (1.) Blacksmiths' tools, with field forge, and materials for smiths' work, and for repairs to the train.
- (2.) Carpenters' tools.
- (3.) Collarmakers' tools and materials for the repair of harness.
- (4.) Armourers' tools and materials for the armourer's shop, and spare parts of rifles and revolvers.
- (5.) Sickles and scythes.

For cavalry, in addition to the above.

- (6.) Saddlers' tools.
- (7.) Reserve of shoes and nails for horses in the ranks.

For artillery and engineers, in addition to above, their own special tools and materials.

With the aid of all these tools and materials, each unit is able to maintain its train, horses, and arms (and in the special services all their matériel) in constant and perfect fitness. The special reserve of horse-shoes and nails in the cavalry (at the rate of two shoes for the fore feet and 0·45 lb. of nails for each combatant horse) independently of the field forges, is considered indispensable to ensure the shoeing of the horses.

In the infantry, field artillery, and engineers there is carried besides a reserve of tools and materials for the repair of boots, reckoning for four shoemakers per company and battery ($\frac{3}{4}$ cwt.). In the cavalry and horse artillery there are none of these articles, as their boots last much longer owing to the nature of their service. The reserve of ready-made boots is all in the Divisional train.

(11.) *Reserve stores and appliances for the train*, independently of those which form the dead weight of each vehicle, are carried so as to avoid delay in exchanging damaged or broken parts. These consist of swingletrees, naves, poles, axles, wheels, and also picketing gear. The quantity of articles of each sort is fixed proportionately to the number of horses and vehicles in the train of each unit. Thus, for instance, the quantity of picketing gear is calculated at one heavy picket for every five horses, and at $3\frac{1}{2}$ feet of rope for every horse. In the cavalry (regular only) picketing gear is carried not only for the draught horses but also for all combatant horses, as there have been instances where the horses in a panic have broken away from the light pickets. Spare harness (collars and breeching) for half the number of reserve horses of each unit are carried on the horses themselves.

(12.) *Articles carried only in the Train of the Cavalry.*—In the cavalry there are carried in addition—

- (a.) Pack saddle fittings, four pairs per squadron and regimental staff. By means of these, each squadron can at once transfer to pack-saddle transport 5 cwt. of gear, that is $1\frac{1}{4}$ cwt. per pack saddle, and a whole cavalry regiment can so transport 35 cwt. The Commanding Officer of the regiments details the baggage to be placed on the pack saddles.¹
- (b.) Appliances for swimming across rivers (bladders, six pairs per squadron).
- (c.) Tools for destroying railways and telegraphs on pack saddles, one per squadron.

¹ In other branches of the Service pack-saddle fittings are carried in the Divisional train.

- (d.) Tools for constructing bridges and ferries, one set for each squadron.
- (e.) Intrenching tools, four shovels and four axes per squadron.
- (f.) Supply of pyroxiline.

All the articles from *c* to *f* are carried together in a special two-wheeled cart. In case of necessity, the pack saddles with the tools for the destruction of the railways and telegraphs are put upon the spare horses.

Distribution of Stores between the Company, Squadron, and Battery Trains, and the actual Regimental Train.

In explaining the general principles of the organization of the train, it has been stated that all stores are divided into company, squadron, or battery, and general regimental stores, and that the packing and also the number of vehicles is so arranged that when each portion of the regiment becomes detached, its corresponding train can be detached with it.

To carry out this fundamental condition, the stores carried in the regimental train are thus distributed :—

A. In the Infantry.

(1.) In the *company train* of each company are carried :—

- (a.) Nearly half the small-arm ammunition (at the rate of twenty-three rounds per man) in a special two-wheeled cart.
- (b.) The whole supply of provisions.
- (c.) Camp kettles and cooking appliances.
- (d.) Reserve of materials and tools for repair of boots.
- (e.) Scythes and sickles.
- (f.) Officers' baggage.
- (g.) Stores of the company hospital dresser.

All these (from *b* to *g*) are packed in two pair-horsed wagons. As the total weight of all the stores does not reach the limit of weight laid down, the spare room is used up for the baggage of Officers commanding battalions, Adjutants, Surgeons, and for certain general reserve stores and appliances for the train.

Consequently the train of each company consists of one small-arm ammunition cart, and two pair-horsed wagons.

(2.) The regimental train carries all the other stores, the small-arm ammunition and field pharmacy in special two-wheeled carts, the medical stores in a special pair-horsed wagon in an infantry regiment, and on a special two-wheeled cart in other independent units. The other impedimenta are carried in pair-horsed wagons. The four-horsed conveyance (*linéika*) for the sick, also belongs to the regimental train.

B. Engineers.

(1.) In the *company train* the same stores are carried as in the infantry, but with the addition of all the engineer train—and besides this *all* the small-arm ammunition is carried and not the half only.

As the supply of provisions in the engineers is much greater than in the infantry (being the regimental and Divisional supply combined), so the company train is also much greater. Thus for instance the composition of the train of each sapper company is as follows :—

| | | |
|----------------------|---|------------------------|
| Supply train | { | 1 S.A.A. cart. |
| | | 1 Officer's cart. |
| | | 4 pair-horsed wagons. |
| Engineer train | { | 1 four-horsed wagon. |
| | | 2 three-horsed wagons. |
| <hr/> | | |
| Total..... | | 9 vehicles. |

With these nine vehicles a sapper company can be detached anywhere and for any length of time without being in want of anything.

(2.) The *battalion train* carries all the other stores.

C. Cavalry.

Besides the division of the train into squadron and actual regimental train, there is a further subdivision of the squadron train into first and second line. The squadron vehicles of the first line go always and everywhere with the squadron; those of the second line only accompany the squadron when circumstances permit or require them to do so, when this is not the case they form the general column with the regimental train.

The *squadron train of the first line* consists of:—

| | |
|-----------------------------------|---------------------|
| S.A.A. carts | } One per squadron. |
| Squadron pair-horsed wagons | |

In the S.A.A. carts there is the whole regulation quantity of small-arm ammunition: in the squadron wagons there are carried a portion of the provisions (biscuits at the rate of 0·9 lb. per man and salt for cooking for two days), all the preserved provisions, camp kettles and appliances, picketing gear, sickles and scythes, pack-saddle fittings, bladders, and Officers' tents (and in Cossack regiments all the Officers' baggage, as there is room for it owing to the absence of picketing gear). The most necessary articles for the Officers (36 lbs. per head) are carried on pack saddles on the led horses.

(2.) In the *squadron train of the second line* (which consists of one pair-horsed wagon per squadron) the remainder of supply of provisions is carried, the field forge with a supply of coal, and the remaining portion of the Officers' baggage. In Cossack regiments there are no vehicles belonging to this line.

(3.) In the *regimental train* everything else is carried.

Thus the *squadron train* consists of—

| | S.A.A. carts. | Squadron pair-horsed vehicles. | | Total vehicles. |
|-----------------------|---------------|--------------------------------|-----------|-----------------|
| | | 1st line. | 2nd line. | |
| Regular cavalry | 1 | 1 | 1 | 3 |
| Cossack regiments ... | 1 | 1 | — | 2 |

D. Artillery.

The organization and division of the train in the artillery is based upon that of the infantry or cavalry.

Composition of Train of a Battery.

| | | Field. | Horse. |
|----------------------|--|--------|--------|
| Artillery train | { 4-horsed wagon | 1 | 1 |
| | { Pair-horsed wagons | 4 | 4 |
| Supply train | { Pair-horsed wagons | 3 | 4 |
| | { Pharmacy cart | — | 1 |
| | { 4-horsed conveyance (<i>linéika</i>) for the sick | — | 1 |
| | | 8 | 11 |

In the field artillery the pharmacy carts and conveyances (*linéika*) for the sick form part of the train of the brigade staff, *i.e.*, form part, so to speak, of the general regimental train of the whole brigade. In the horse battery there is one wagon more than in the field battery, because the loads have to be lighter. A part of the Officers' baggage in horse batteries is to be on pack saddles as in the cavalry.

Thus the principle of the individuality of the company, squadron, and battery, and of the general regimental stores, is carried out in all arms of the Service. In *gens d'armes* squadrons—which, according to the nature of their service, are nearly always broken up into sections—each section has its own special vehicle.

On the introduction of the new organization and of the vehicles of the new pattern the regimental train will be composed as follows:—

(1.) *Corps Headquarters*.—8 pair-horsed wagons with 19 horses (including 2 spare and 1 riding horse), and 10 trained soldiers. In addition to these there are 2 pair-horsed wagons for the staff of the Officer commanding the artillery of the corps.

(2.) *Headquarters of an infantry Division*.—4 pair-horsed wagons with 10 horses (1 spare and 1 riding) and 4 train soldiers.

(3.) *Infantry regiment*.—33 S.A.A. carts (including 16 company carts), 4 pharmacy carts, 1 cart for Commanding Officer, 5 Officers' carts of the first line (1 per battalion and 1 for regimental headquarters); total, 43 carts. 32 company wagons and 7 regimental wagons (including medical wagon); total, 39 pair-horsed wagons. Four hospital conveyances (*linéika*). Grand total, 86 vehicles, 158 horses (137 draught, 14 reserve, and 7 riding) and 103 rank and file.

(4.) *Staff of a rifle brigade*.—2 pair-horsed wagons.

(5.) *Rifle battalion*.—8 S.A.A. carts (including 4 company carts), 1 pharmacy cart, 1 medical cart, 1 Commanding Officer's cart, 1 Officer's cart of first line, 1 for the treasury and office; total, 13 carts. 11 pair-horsed wagons, one hospital *linéika*. Grand total, 25 vehicles, 45 horses (39 draught, 4 spare, and 2 riding), and 30 rank and file.

(6.) *Headquarters of an artillery brigade*.—2 pharmacy carts, 1 medical cart, 1 for Officer commanding the brigade, 2 for administrative services; total, 6 carts; 3 hospital *linéikas*. Grand total, 12 vehicles, 27 horses (24 draught, 2 spare, 1 riding), and 16 rank and file.

(7.) *Battery* (heavy and light). (a.) Artillery train: one 4-horsed wagon and 4 pair-horsed wagons. (b.) Supply train: 3 pair-horsed wagons. Grand total, 8 vehicles, 21 horses (18 draught, 2 spare, and 1 riding), 10 train soldiers.

Consequently in the *whole artillery brigade* (headquarters and 6 batteries) there are 6 carts, 45 pair-horsed wagons, 9 four-horsed wagons; total, 60 vehicles, 153 horses, and 77 rank and file.

(8.) *Headquarters of cavalry Division*.—6 pair-horsed wagons, including 3 for the conveyance of the clerks and other rank and file at headquarters, so that it can always keep up with the Division; 13 horses, 6 train soldiers.

(9.) *Cavalry regiment*.—6 S.A.A. carts, 1 pharmacy cart, 1 medical cart, 1 veterinary cart, 1 for Officer commanding regiment, and 1 for regimental headquarters; total, 11 carts. Six squadron wagons of first line, 6 of the second line; regimental wagons—14 for various stores, 3 for conveyance of dismounted non-combatants; total, 29. 2 hospital *linéikas*. Grand total, 42 vehicles, 85 horses (including 8 spare), 48 train soldiers. In a Cuirassier regiment (4 squadrons) there are 34 vehicles (viz.: 9 carts, 23 pair-horsed wagons, and 2 hospital *linéikas*), 69 horses (including 6 spare), and 39 train soldiers.

(10.) *Cossack regiment* (of 6 squadrons).—6 S.A.A. carts, 1 pharmacy cart, 1 medical cart, 1 veterinary cart, 1 for Commanding Officer; total 10. 20 pair-horsed wagons, 2 hospital *linéikas*. Grand total, 32 vehicles, 64 horses (6 spare), and 37 train soldiers. In a four-sotnia regiment there are 25 vehicles (8 carts, 15 pair-horsed wagons, and 2 *linéikas*), 51 horses (5 spare), 29 train soldiers.

(11.) *Horse artillery battery*.—(a.) Artillery train: 1 four-horsed wagon, and 4 pair-horsed wagons; (b.) Supply train: 1 pharmacy cart, 4 pair-horsed wagons, and 1 *linéika*. Grand total, 11 vehicles, 28 horses (25 draught 2 spare, 1 riding), 14 train soldiers.

(12.) *Headquarters sapper brigade*.—6 pair-horsed wagons, 52 horses (including 40 of the general horse reserve of the brigade), and 26 train soldiers.

(13.) *Sapper battalion*.—(a.) Engineer train : 8 three-horsed, and 4 four-horsed wagons. (b.) Supply train : 4 S.A.A. carts, 1 pharmacy cart, 1 medical cart, 1 for Commanding Officer, 5 Officers' carts (1 per company and battalion staff); total, 12 carts. 21 pair-horsed wagons, 1 hospital *linéika*. Grand total, 46 vehicles, 114 horses (98 draught, 10 spare, 6 riding), and 61 train soldiers.

(14.) *Pontoon battalion*.—(a.) Pontoon train : 58 fourgons, 372 horses (24 spare), and 144 drivers. (b.) Supply train : 2 S.A.A. carts, 1 pharmacy cart, 1 medical cart, 1 for Commanding Officer; total, 5 carts. 14 pair-horsed wagons, 1 hospital *linéika*; total, 20 vehicles, 14 horses (4 spare), and 24 train soldiers. Grand total train, 78 vehicles, 413 horses, 168 rank and file.

(15.) *Field Telegraph park*.—(a.) Telegraph train : 4 four-horsed station carriages, 24 four-horsed wagons for telegraph stores; total, 28 vehicles, 62 horses¹ (including 4 spare and 2 riding), and 44 train soldiers. (b.) Supply train : 1 cart for Officer commanding park and 14 pair-horsed wagons; total, 15 vehicles, 32 horses (including 3 spare), and 16 train soldiers. Grand total, 43 vehicles, 94 horses, 60 train soldiers.

(16.) *Field Engineer park*.—(a.) Engineer train : 80 pair-horsed wagons, 196 horses (including 20 spare and 16 riding), and 103 train soldiers. (b.) Supply train : 1 cart for Commanding Officer of park, 5 pair-horsed wagons; total, 6 vehicles, 11 horses, and 6 train soldiers. Grand total train, 86 vehicles, 207 horses, 109 train soldiers.

(17.) *Gens d'Armes squadron*.—7 pair-horsed wagons (1 per section, and 2 general), but in the guard squadron 1 cart and 5 pair-horsed wagons (1 per section and 1 general). The commander and Officers are granted allowance for the purchase of their own single-horse vehicles, harness, and horses, 1 for each Officer, and they are granted forage allowance. In return they are bound to carry in their vehicles the kits and supplies for the gens d'armes who are attached to them when on detached duties.

Private train is only allowed to the higher Commanding Officers, commencing with Officers commanding independent bodies of troops, according to the scale laid down in a special table. This table will be appended to the Regulations for Allowances in Time of War, which is now being drawn up afresh to replace the regulations in 1876.

Division of Regimental Train into Lines.

When marching in proximity to the enemy, the regimental train is divided into two lines; the 1st always follows after its own unit, and the 2nd is detached to the rear of the whole marching column.

The 1st line is made up so as to ensure the supply of the most pressing requirements of the troops. It comprises—

(a.) Half the company S.A.A. carts in the infantry, and all the S.A.A. carts in the cavalry and engineers. The supply of ammunition for each man on the establishment is thus :—12 rounds in the infantry, 36 in the cavalry, and 23 in the engineers. But as the establishment will never be complete, it may be reckoned that there will be at least 16 rounds per man in the infantry, 40 in the cavalry, and 25 in the engineers; that is, together with the supply carried on the person, there will be 100 rounds per man in the infantry, 76 in the cavalry, and 85 in the engineers. This is enough for a very obstinate fight, all the more so as, if there is the prospect of such a struggle, the Commander of the force may increase the number of S.A.A. carts of the first line for the infantry.

¹ This is so in the original : therefore either the number of horses is too small, or the wagons are only pair-horsed.—Tr.

(b.) *All the hospital train, i.e., all the pharmacy carts, medical wagons (or carts), and hospital linéikas.* These will be most of all in an infantry regiment, viz., nine vehicles. This is a large number, but they are indispensable for giving aid to the sick on the march, and to the wounded on the field of battle.

(c.) *A portion of the Officers' baggage, viz.:*—In the infantry, engineers, and field artillery, for the regimental (or brigade) Commander all his baggage ($3\frac{3}{4}$ cwt.) in a special two-wheeled cart, for the other Officers $15\frac{1}{4}$ lbs. baggage each, in canvas bags, a portion of the field tents, and part of the forage for the horses. All this—for infantry in the special two-wheeled carts, one for headquarters and for each battalion—for artillery in a four-horsed wagon of the artillery train, which will always be in the 1st line.

In the cavalry and horse artillery 36 lbs. for each Officer, on pack saddles on the led riding horses.

The 2nd line comprises all the remaining vehicles. The engineer train is detailed for the 1st or 2nd line, according to circumstances, at the discretion of the commander of the force.

When the train is divided, the 1st line follows after its own units under the command of the Officer in charge of the arms, while the 2nd line, belonging to each unit, remains under the command of its regular commander, and forms a general train column, the head of which is 500 paces from rear of the main body. This distance in the sphere of probable conflict with the enemy may be increased to $5\frac{1}{2}$ miles, but not more; otherwise the train will not arrive at the halting-place in sufficient time.

For facility of reference, the following tables give the train of each of the principal units, with the line to which the different vehicles belong, and the depth of column:—

1. Infantry Regiment.

| | Vehicles. | Horses (exclusive of riding). | Depth of column in paces. ¹ |
|---|-----------|-------------------------------------|--|
| 1st Line. | | | |
| 1st echelon of Company S.A.A. carts | 8 | 8 | 36 |
| Pharmacy carts..... | 4 | 4 | 18 |
| Medical wagon | 1 | 2 | 12 |
| Hospital linéikas | 4 | 16 | 48 |
| Officers' carts (1 for C.O., 1 for regimental H.Q., and 1 per battalion).... | 6 | 6 | 27 |
| Spare horses | — | 4 | 6 |
| Total 1st line..... | 23 | 40 | 147 |
| 2nd Line. | | | |
| 2nd echelon of Company S.A.A. carts | 8 | 8 | 36 |
| Regimental S.A.A. carts | 17 | 17 | 77 |
| Company pair-horsed wagons..... | 32 | 64 | 384 |
| Regimental train | 6 | 12 | 72 |
| Remainder of spare horses | — | 10 | 15 |
| Total 2nd line | 63 | 111 | 584 |
| Total infantry regiment | 86 | 151 | 731 |

¹ The basis of calculation is as follows:—Carts go two abreast, and cover a depth of 9 paces; pair-horsed and 4-horsed wagons, in single file, occupy 12 paces. In order to allow for opening out on the march 3 paces are added for each vehicle.

2. *Artillery Brigade.*

| | Vehicles. | Horses (exclusive of riding). | Depth of column in paces. |
|--|-----------|-------------------------------------|---------------------------------|
| 1st Line. | | | |
| Carts—2 pharmacy, 1 medical, 1 for O.C. brigade | 4 | 4 | 18 |
| Hospital <i>linéikas</i> | 3 | 12 | 36 |
| Artillery wagons, 1 per battery | 6 | 24 | 72 |
| Total in 1st line | 13 | 40 | 126 |
| 2nd Line. | | | |
| Vehicles for brigade staff { Carts | 2 | 2 | 18 |
| Pair-horsed wagons | 3 | 6 | 36 |
| Battery { Artillery train, pair-horsed wagons .. | 24 | 48 | 288 |
| vehicles { Supply " " " " .. | 18 | 36 | 216 |
| Spare horses | — | 14 | 21 |
| Total 2nd line | 47 | 106 | 579 |
| Total artillery brigade..... | 60 | 146 | 705 |

3. *Cavalry Regiment (Six Squadron Establishment).*

| | Vehicles. | Horses (exclusive of riding). | Depth of column in paces. |
|--|-----------|-------------------------------------|---------------------------------|
| 1st Line. | | | |
| S.A.A. carts | 6 | 6 | 27 |
| Pharmacy and medical carts | 2 | 2 | 9 |
| Hospital <i>linéikas</i> | 2 | 8 | 24 |
| Squadron vehicles of 1st line | 6 | 12 | 72 |
| Officers' led horses—one for every Officer and official on the establishment (with the most necessary articles on pack saddles)..... | — | 40 | 60 ¹ |
| Grooms with them, one man to every pair of Officers' horses | — | 20 | |
| Total 1st line..... | 16 | 88 | 192 |
| 2nd Line. | | | |
| Squadron vehicles | 6 | 12 | 72 |
| Regimental train—pair-horsed wagons | 17 | 34 | 204 |
| carts—veterinary, C.O., and H.Q. of regiment | 3 | 3 | 18 |
| Spare horses | — | 8 | 12 |
| Total 2nd line..... | 26 | 57 | 306 |
| Total cavalry regiment..... | 42 | 145 | 498 |

¹ Horses three abreast.

4. *Cossack Regiment (Six sotnias).*

| | Vehicles. | Horses (exclusive of riding). | Depth of column in paces. |
|---|-----------|-------------------------------------|---------------------------------|
| 1st Line. | | | |
| S.A.A. carts | 6 | 6 | 27 |
| Pharmacy and medical carts | 2 | 2 | 9 |
| Hospital <i>linéikas</i> | 2 | 8 | 24 |
| Squadron vehicles of 1st line | 6 | 12 | 72 |
| Led Officers' horses | — | 22 } | 33 |
| Grooms with them ¹ | — | 11 } | |
| Total 1st line..... | 16 | 61 | 165 |
| 2nd Line. | | | |
| Regimental train—pair-horsed wagons | 14 | 28 | 168 |
| " " carts for the C.O. and veteri- nary stores | 2 | 2 | 9 |
| Spare horses | — | 6 | 9 |
| Total in 2nd line | 16 | 36 | 186 |
| Total Cossack regiment | 32 | 97 | 351 |

5. *Battery of Horse Artillery.*

| | Vehicles. | Horses (exclusive of riding). | Depth of column in paces. |
|---|-----------|-------------------------------------|---------------------------------|
| 1st Line. | | | |
| Pharmacy cart | 1 | 1 | 9 |
| Hospital <i>linéika</i> | 1 | 4 | 12 |
| Artillery train—special pattern wagon | 1 | 4 | 12 |
| Led Officers' riding horses, 1 per Officer and official on establishment | — | 7 } | 11 |
| Grooms for above, 1 man per pair of Officers' horses..... | — | 4 } | |
| Total 1st line..... | 3 | 20 | 44 |
| 2nd Line. | | | |
| Artillery train—pair-horsed wagons | 4 | 8 | 48 |
| Supply " " " | 4 | 8 | 48 |
| Spare horses | — | 2 | 3 |
| Total 2nd line | 8 | 18 | 99 |
| Total battery horse artillery.. | 11 | 38 | 143 |

¹ At the same rate as in a cavalry regiment, but the number of Officers on the establishment is less.

charge of the train and its sections, so that they may be able really to control the train and to maintain the strictest order in it.

If the 1st section is detached the Officer in charge of the arms takes command of it. As the warlike stores are in his charge, it is most natural that he should command this portion of the train. If the troops come into action he is bound to organize and maintain a regular supply of ammunition. The hospital train and the Officers' carts, or pack-animals of the 1st line, remain in his charge only until the dressing station has been set up; after this has been done they pass under the orders of the senior surgeon. It is considered more convenient to concentrate the Officers' carts, or pack-animals, with their servants, during the action at the dressing station, because, if an Officer is wounded, his kit and servant are then at hand. The servants can make themselves generally useful at the dressing station, while at all other points of the field they will only be in the way.

The regular commander of the train, when it is split up, always remains with the 2nd line, as this forms the greater portion; and besides, on account of the distance which separates it from the troops, it is more necessary to have with it a commander whom the men know, and who knows them.

Duties and Powers of the Personnel of the Train.

The duties and powers of the personnel of the train have hitherto not been accurately and fully laid down anywhere. Now this omission is rectified. All the duties of the commander of the train for each independent unit are accurately defined, and he is given the powers of a company commander if he is an Officer, of a sergeant if he is of lower rank. All ranks marching with the train, although they may not be under the command of the commander, are obliged to carry out his orders. No one except the commander may dare to give orders regarding the train, and the commander takes orders only from the Officer charged with the interior economy of the corps, or from the commander of the unit himself. The duties of the commander of each train-section are accurately laid down, and he has the powers of a sectional non-commissioned officer. Finally, a detailed list of the duties of each train soldier has been made out. All the details of service in the train are laid down in the special instructions, which consist of three main divisions, viz.:—(1) Order of march; (2) Order of bivouacking or billeting; (3) Disposal and duties of the train during action. The train is to be guided by these instructions in peace time as well.

II. Divisional Train.

The Divisional train is laid down in war time for each infantry and cavalry Division (a rifle brigade has a brigade train). Its object is threefold: (1) Unity of administration of all transport composing the general impedimenta of the whole Division, as well as of the transport which is detached from the regiment to form part of the general Divisional column; (2) The uninterrupted and systematic maintenance of a reserve for the regimental train; (3) The organization of a connecting link between the regimental train and the nearest stores and magazines.

Hitherto the transport temporarily relegated to the general train of the Division (such, for instance, as regimental wagons with the four days' reserve of provisions) had no regular system of administration, and that which belonged, or was attached temporarily to the whole Division (as, for instance, the Divisional hospitals, artillery parks, sections of engineer parks) had no *general* commander. Accordingly there was no unity or agreement in the train, and consequently there was no order.

Strictly speaking the normal basis of the Divisional train should be its complete individuality, independent cadres in peace, special training, separate

stores, special establishments and tables. But as the formation of a special category of train troops would be very expensive, and would increase the military budget, an organization has been worked out which gives rise to the least expenditure in peace, and which at the same time is sufficiently well suited to a rapid transition to the war footing.

In peace there are neither separate cadres, nor separate stores. All the articles carried in the Divisional train are to be kept with the regiments and artillery brigades, and only a very small portion will be in charge of the district intendants' administrations. The personnel—Officers and officials—is appointed beforehand by the commander of the Division from those under his command, whether on the active or reserve lists, provided that they are well known to the Divisional Commander as trustworthy persons. The rank and file are detailed in the lists of the headquarter staff.

The Divisional train consists of a commander and three permanent sections : (1) The general ; (2) The supply ; and (3) The sanitary sections. In addition to this there may be two more temporary sections : (4) The artillery section—consisting of the artillery parks, which may be attached to the Divisions (ordinarily the parks form part of the whole army corps) ; and (5) The engineer section, in case of a section of a field engineer park, or of a telegraph park being attached to a Division. The last *three* sections forming a part of the Divisional train, are completely organized according to their own special regulations, and are under the orders of the commander of the Divisional train only as regards discipline on the march and at the halt, and also as regards quarters and marches. The first *two* sections (the general and the supply), which have received a new organization by the present regulations, are placed under the orders of the commander of the Divisional train in all respects.

The composition of the sections is as follows :—

(1.) *General Section.*—(a) Vehicles of the staff of the Divisional train ; (b) Vehicles of all the troops composing the Division, detached from the regimental train either permanently or temporarily (with the exception of the vehicles with provisions) ; and (c) The special horse reserve for the immediate supply to meet losses of draught and of artillery horses.

(a.) The vehicles of the staff of the Divisional train and of the general section carry, for the use of the personnel, the same stores, in the same quantity, as are carried in the regimental train, *i.e.*, supplies, kettles and appliances, Officers' baggage, &c.

(b.) The regimental vehicles, which form part of the permanent portion of the Divisional train, carry all those stores belonging to the separate units which there is no immediate necessity to have in the regimental train, *viz.*, the field church, intrenching tools, reserve of boots (thirty-two pairs per company and battery), reserve of made-up clothing (four sets per company and battery), with materials for their renewal and repair, pack-saddle gear (the number of pack-saddles is equal to the number of pair-horsed vehicles of each separate unit), and a reserve of horse-shoes and nails for the number of horses on the establishment (at the rate of two fore-shoes and $\frac{1}{2}$ -lb. nails per horse).

(c.) The horse reserve is calculated at about 3 per cent. of the total number of artillery and draught horses in the Division.

The composition of the general section is of the same nature for infantry Divisions and for rifle brigades. In cavalry Divisions there is this difference, that there are no intrenching tools and pack-saddle gear (for they are both in the regimental train) and there are no materials for the renewal and repair of clothing, inasmuch as cavalry has no time for this.

For Cossack regiments and batteries only a reserve of shoes and nails is carried, as the representatives of Cossack troops considered a reserve of boots and clothing unnecessary.

The field church is only in the general section of the train of an infantry Division.

If it should be necessary to diminish the dimensions of the regimental train, all the vehicles which are temporarily detached by it should also form part of the general section of the Divisional train, with the exception of the vehicles with provisions and kettles, which are attached to the supply section. But if it is necessary to march without any train, the regimental train remains in rear as an organized body, either independently of the Divisional train, or forms part of it for a time, as is most convenient. In both cases order is assured.

(2.) *The Supply Section* consists—for infantry Divisions and rifle brigades—of two sets of transport—the expense, and the reserve: for cavalry Divisions of one set—the expense. The expense transport carries a four days' reserve of biscuits and groats, eight days' salt, and ten days' tea and sugar for the establishment of the whole Division. The reserve transport carries a similar quantity, and serves to feed the expense transport with supplies from the nearest magazines, and forms a reserve of means of transport for the Division in general. No reserve transport is laid down for a cavalry Division, because, from the nature of its service, it cannot be fed by transport, but must subsist on the means of the country. Reserve transport is also not laid down unconditionally for infantry Divisions and rifle brigades. If from the character of the operations, or from the conditions of the theatre of war, all or some Divisions can do without train, reserve transport is not supplied to them, but it forms a portion of the transport of the army: i.e., a general reserve of its means of transport.

(3.) *The Sanitary section* exists only in infantry Divisions, and consists of a Divisional lazaret, which serves to give aid to the sick on the march, and to the wounded on the battle-field (for the formation of the dressing station), and of two Divisional hospitals, each of 200 beds, which can be opened for the treatment of the sick and wounded, wherever required. Each of these mobile medical establishments forms an administrative unit: the administration of all three is united in the person of the Divisional surgeon, but in all matters relating to allotment of quarters, marching, and discipline on the march, all the medical establishments are under the orders of the Commander of the Divisional train. It has already been stated above that the commanders of artillery park brigades and of field engineer and telegraph parks have the same relations towards him, if these bodies are temporarily attached to the Division.

Speaking in general terms the command and supervision is concentrated in the person of the commander of the Divisional train, but the immediate control of the portions of the train and the supervision of their interior economy is the duty of the commanders of the various sections. A complete centralization of all the branches of administration of the Divisional train in all its parts and in all its relations would be impracticable: the commander of the Divisional train would be quite powerless to deal with so large, so complicated, and so varied a system of economy, which would in addition have to be carried out under exceedingly difficult circumstances.

Accordingly it was deemed more practical to grant the commanders of sections of the Divisional train the powers of Officers commanding independent units, with all the resultant responsibilities and duties. But the Commander of the whole Divisional train, while exercising a general superintendence over the whole service of the train, is only obliged to carry out a general supervision in matters of interior economy, which are in the hands of his subordinates. This obligation is rendered the more easy by his not being personally interested in the interior economy of the train.

The organization of the separate portions of the Divisional train and the method of control must now be considered.

This organization is based upon the same principle of the individual supply of each independent unit (of convenience in dividing the Divisional

train in case the parts of the Division are separated), as held good in the case of the organization of the regimental train. In the case of the regimental train it was taken as a rule that each company, squadron, or battery should have its own vehicles; here special vehicles are allotted to each regiment (or rifle battalion), artillery brigade, and horse battery, both in the general section, and in the expense and reserve transports. In the train of an infantry Division, on account of the large number of vehicles, the vehicles of each regiment and artillery brigade form a special subdivision both in the general section and in each transport. The vehicles forming the special train of the section or transport, as well as those in which the reserves of all sorts for the Divisional train and for the Divisional Staff are carried, are grouped into a special subdivision. Thus, the general section, and the expense and reserve transports of the train of an infantry Division, are each divided into six subdivisions. The first four belong to the corresponding regiments, the 5th to the artillery brigade, and the 6th belongs specially to the Divisional train and to the Divisional Staff. In the general section the horse reserve forms part of the 6th subdivision. The subdivisions of the general section are commanded by non-commissioned officers. In the expense and reserve transports the subdivisions are so large that it is deemed necessary to group each pair of subdivisions (1st and 2nd, 3rd and 4th, 5th and 6th) under the command of an Officer, who has the powers of a company commander.

Thus, the commanders of the general section and of the expense and reserve transports in the train of infantry and cavalry Divisions are guided in the exercise of their functions by the regulations for the administration of a regiment, while the commanders of each pair of subdivisions of the expense and reserve transports are guided by the regulations for the economy of a company. In the train of a rifle brigade, on account of its numerical inferiority, the commander of the whole train enjoys the powers of a commander of an independent unit in all respects, and, at the same time, superintends the general section as well—while each transport of the supply section is in charge of an Officer with the powers of a company commander.

This organization gives the power, in case regiments or batteries are detached from a Division (or in case a rifle brigade is broken up), of detaching with the troops the corresponding portions of the train.

Example 1. The 3rd infantry regiment of a Division with two batteries are detached to form a special force. At the same time the train detaches the 3rd subdivisions of the general section of the expense and reserve transports, in their entirety, and the number of vehicles corresponding to the two batteries from the 5th subdivision. The Commander of the non-combatant company of 3rd infantry regiment takes the general command over the whole of the train so detached.

Example 2. A special force is formed of a brigade of cavalry with a horse artillery battery. The Divisional train detaches the corresponding special vehicles from the general section and from the expense transport, and they are attached to the regimental train of the 2nd line.¹

Example 3. A special force is formed of two infantry regiments of different Divisions, of a rifle brigade, of three field batteries of different brigades, and of a Cossack regiment. The Divisional (and brigade) transport detaches the corresponding subdivisions and special vehicles of the general section, of the expense and reserve transports, and they are concentrated in a train for the force. The senior subdivisional commander takes command, or a special Officer may be appointed to the command of the train. If there is no necessity for the force to divide its whole train into three lines, the portions which have been detached from the Divisional train may be united with the corre-

¹ The men and horses, with the vehicles of each regiment and battery, are attached for rations to the troops to which they correspond.

sponding regimental train of the second line, and a general commander of the whole train column need only be appointed.

In one word, the organization is so pliant that it is possible to form all sorts of combinations as may be found most convenient.

If it is not necessary to attach to the force detached all the corresponding portions of the Divisional train, it is only requisite to order what portion is to be detached and what is to remain behind. The organization is thereby in no way thrown out.

When a detached force is broken up, the sections and vehicles which were attached to it are likewise broken up and return to the portions of the train to which they regularly belong.

We will now explain the method of keeping the stores, mobilization, the duties of the divisional train, and the rules for its disbandment.

It has already been stated that the Commander of the whole train and the Officers of the general and supply sections are nominated in peace-time by the Divisional Commander. The officials of the sanitary section are appointed in accordance with the regulations for the medical establishments. All the material is kept by subdivisions, with the corresponding bodies of troops. The stores of the 6th subdivisions (for the Divisional staff and Divisional train) is kept at special points, selected by the Chief Intendance Department.

On mobilization being ordered, the subdivisions (or separate vehicles) are put on the war footing by the troops to which they correspond, at the points at which the stores are kept, and are then sent off to the points of concentration. The rank and file of horses are despatched to the place of mobilization according to the lists kept by the Headquarter Staff, and the Officers according to the orders of the Divisional Commanders. The commander and all Officers are appointed in army corps orders; they retain their uniform, and during the whole of the war they are shown as being "on command;" but when the train is broken up, they return to their regiments. Thus the train service is performed by no temporary outsiders, taken here, there, and everywhere, or from the retired list, for the time of the war, but is entrusted to Officers belonging to the corps, who are known to the authorities and to their comrades, and who feel secure as to their fate on the termination of the campaign. If any Officer is found unfit for the train service, the Officer commanding the corps of his own authority can remove him, and can appoint another Officer recommended by the Divisional Commander.

As the portions of the Divisional train arrive at the point of concentration, the commander of the Divisional train inspects them in detail, and then the whole train is inspected by the Officer commanding the Division, and takes the field with it.

The method of supplying the regimental trains from the Divisional train is settled by the Divisional Commander himself in accordance with circumstances. He orders the troops either to send their demands through the Divisional staff, or straight to the Commander of the Divisional train. It is only necessary that the method of supply which the Divisional Commander prescribes (and any subsequent alterations) should be promulgated in Divisional orders, and not verbally. The staff of the Division is obliged to (a) make known to the troops the distribution of the Divisional train, and (b) to despatch in sufficient time to the commander of the Divisional train all routes, dispositions, and other written orders relating to movements or to possible actions. If these rules are accurately observed, it may be regarded as certain that the transport service will be accurately performed.

All formalities, which might cause loss of time, are forbidden by the regulations as far as possible. If the troops have to draw anything from the Divisional train, in extreme cases the requisition may be made with the signature of any Officer of the regimental staff; and the requisition is to be at once complied with, and it serves as a voucher for the Divisional train.

The issue of the stores required is considered to be entirely vouched for if there is a receipt entered against the issue in the store account.

The method of delivery of stores from the Divisional train to the troops is not laid down beforehand; consequently, the empty vehicles belonging to the troops may either be sent to the Divisional train to be filled, or *vice versâ*, as most convenient. It is only required that in the latter case the troops should not detain the vehicles of the Divisional train, and should send them back immediately; the Divisional Commander only is able to alter their destination. If this is done in his name, it must be done in writing.

Supplies issued from the expense transport must be immediately replenished from the reserve transport. The commander of the expense transport is responsible for this: he must, without delay, require the corresponding quantity of stores to be brought from the reserve transport, and the commander of the latter must at once despatch what is wanted. The method of making demands and of vouching for them is the same as that explained above. The reserve transport in its turn is replenished from the nearest magazines, or by other means according to the orders of the Corps Intendant.

The interior economy, correspondence, and accounts of the various parts of the Divisional train are carried out according to the rules and forms laid down for independent units, or in accordance with the regulations for the economy of a company, as the case may be. The only special articles of correspondence and accounts are:—(1) The store account, in which are entered the issues and receipts of stores conveyed for the troops, with the acknowledgments of the recipients against the issues; (2) the route book, which is kept only in the reserve transport. As this transport is always moving between the Divisional train and the nearest magazines, and consequently as it is without the immediate control of the commander of the Divisional train, it is necessary to have some documentary record of its service from day to day, so that it may be clearly seen what it was doing; and if it was delayed, the reason for such delay. So that this can be done, and so that it can be seen from the records, the regulations give exact instructions as to the entries to be made in it. Accuracy in keeping the route book, while enabling the service of the reserve transport to be verified, at the same time protects the commander from undeserved accusations and imputations.

On the conclusion of the war, the Divisional train is only broken up when the troops return to their permanent stations. A special committee, nominated by the Divisional Commander, takes stock of the stores remaining on hand, draws up lists and reports, and gives orders for the stores to be handed over to those troops and magazines which are entrusted with their custody. Moneys remaining over after the stock-taking are handed over to the nearest treasury chests, and receipts are taken for them. The Officers return to their corps, and the rank and file are dismissed to the reserve. The horses are sold or are told off for other duties, according to the orders of the War Minister.

Tables and Establishments of the Divisional Train.

The articles to be carried in the Divisional train were mentioned above. We must now state the number of vehicles and horses of which it should consist.

First, a few general explanations.

(1.) *Vehicles of the Divisional Train.*—As the troops have an immense number of light pair-horsed vehicles of the 1876 pattern, which are eventually to be replaced by wagons and carts of the 1884 pattern, it would be impossible to do away with these vehicles, which are quite serviceable. When the proper limit of weight has been fixed, they may serve quite well for a long time. Accordingly, it has been decided to transfer them from the regimental to the Divisional train, in which they will remain till they become unserviceable; consequently, the Divisional train will still for a long time consist of vehicles

of the 1876 pattern. In view of this, its dimensions are calculated upon the capacity and limit of weight of the vehicles of the 1876 pattern; and the number of horses and men is fixed in accordance with their numbers.

It has also been decided to fit these vehicles for three-horsed draught so as to increase the useful weight, and consequently to diminish the number of vehicles in the Divisional train. The experience of the sapper battalions—(the engineer train consists almost entirely of three-horsed vehicles of the 1876 pattern)—has already proved that this can be done very simply, conveniently, and cheaply. From their construction and capacity, the vehicles of 1876 pattern are able to carry even more than the limit of weight.¹ The Divisional train of a Cavalry Division and the brigade train of a rifle brigade is to be composed of pair-horsed vehicles of the same pattern. This is considered more advantageous on account of the quantity and weight of the baggage.

The limit of weight of the whole system is fixed as follows:—For three-horsed draught at 25 cwt. ($8\frac{1}{2}$ cwt. per horse), and for pair-horsed draught at 21 cwt. ($10\frac{1}{2}$ cwt. per horse). The quantity of useful weight is then: for three-horsed draught, 11·5 cwt.; for pair-horsed, 8 cwt. The limit of weight is somewhat greater than in the regimental train ($1\frac{1}{4}$ cwt. more for a pair-horsed vehicle), as less mobility is required of the Divisional train. But even this limit of weight is much less than formerly: hitherto a loaded *wagon* of the 1876 pattern, harnessed with two horses, weighed $25\frac{1}{2}$ cwt. in the regimental train; now it will weigh not more than 21 cwt. (or $4\frac{1}{2}$ cwt. less) in the Divisional train. And for three-horsed draught $1\frac{1}{2}$ cwt. less is ordered to be carried than was formerly carried with two-horsed draught.

Hence it is evident what decisive steps have been taken to increase the mobility of our train.

(2.) *Personnel of the Divisional Train.*—Special tables and establishments for the Divisional train have been drawn up. (1), for an infantry Division (with deviations to meet the peculiarities of the composition of the train of the Divisions numbered from 42 to 65²; (2), for the 1st Guard Cavalry Division; (3), for the 2nd Guard Cavalry Division; (4), for the remaining Cavalry Divisions; and (5), for a rifle brigade.

For each Division (and rifle brigade) there have been drawn up separately: first, the tables and establishments of the Staff and general section, and then those of the expense and reserve transports, and finally the total number of all ranks, of the vehicles and horses of the whole Divisional train. The hospital section is not included, as its establishments and tables will be fixed by the special regulations for the medical establishments.

Each table of establishments shows separately the personnel, vehicles, and horses of each subdivision, and where there are no subdivisions—the special vehicles, with the men and horses belonging to them for each regiment, independent battalion and battery.³ The duty of each person is shown, so that it can at once be seen what he is wanted for.

(3.) *Horses.*—The ration for the horses is fixed at the same rate as in the regimental train, i.e., at the rate of $13\frac{3}{4}$ lbs. oats and $13\frac{1}{2}$ lbs. hay per day. In addition to the draught horses there are also detailed: (a), spare horses 10 per cent.; (b), horse reserve of the Division, ten horses per regiment and per battery; (c), Government riding horses for all Officers and officials, and for some non-commissioned officers.

The principal data of the tables and establishments are given below.

¹ During the war of 1877–78 many corps harnessed their vehicles with 4 horses, and then loaded them with as much as they would hold. The vehicles stood it.

² i.e., Reserve Divisions.—Tr.

³ The nature and quantity of the stores are shown in the tables, also for each independent unit separately.

I. *Divisional Train of an Infantry Division.*(1.) *Staff of the whole Train and General Section.*

| | Subdivisions of the General Section. ¹ | | | | | |
|---|---|------|------|------|------|--------------|
| | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. |
| | cwt. | cwt. | cwt. | cwt. | cwt. | cwt. |
| 1. Field church..... | 16 | — | — | — | — | — |
| 2. Intrenching tools, viz., 160 shovels, 48 picks, 48 mattocks, 384 axes, and 16 crowbars per regiment. In the artillery the tools are with the batteries. In the 6th Subdivision they are on the train men: half with axes, half with shovels..... | 31 | 31 | 31 | 31 | — | — |
| 3. Made-up clothing, 68 suits per regiment, 24 per artillery brigade, and 40 for Divisional train..... | 7½ | 7½ | 7½ | 7½ | 2½ | 4¼ |
| 4. Field tailor's shop (material for repair and renewal of clothing)..... | 2½ | 2½ | 2½ | 2½ | 1 | 1 |
| 5. Boots, 544 pairs per regiment, 192 per artillery brigade, and 96 for Divisional train... | 15½ | 15½ | 15½ | 15½ | 5½ | 2¾ |
| 6. Material and tools for repair of boots..... | In the regimental train | | | | | ¾ |
| 7. Pack saddle gear (Diterich's system), 40 per regiment, 21 per artillery brigade..... | 9½ | 9½ | 9½ | 9½ | 5 | — |
| 8. Reserve horse-shoes and nails for 150 horses per regiment, and artillery brigade, and for 1,200 horses per Divisional train..... | 7¼ | 7¼ | 7¼ | 7¼ | 7¼ | 57½ |
| 9. Horse reserve of the division (10 horses per regiment and battery), total 100 horses. Spare harness on half of them..... | .. | .. | .. | .. | .. | (100 horses) |
| 10. Picketing gear for horse reserve..... | .. | .. | .. | .. | .. | 2¾ |
| 11. Baggage of personnel of Staff of Divisional train and general section ² | .. | .. | .. | .. | .. | 35¼ |
| Total..... | 89 | 73 | 73 | 73 | 21¼ | 104¼ |
| Vehicles—3-horsed..... | 9 | 7 | 7 | 7 | 2 | 9 |
| „ 2-wheeled carts ³ | .. | .. | .. | .. | .. | 3 |
| Horses—Draught..... | 27 | 21 | 21 | 21 | 6 | 30 |
| „ Spare..... | 2 | 2 | 2 | 2 | .. | 102¼ |
| „ Riding..... | .. | .. | .. | .. | .. | 8 |
| Officers and officials ⁵ | .. | .. | .. | .. | .. | 6 |

¹ It is to be recollected that the 1st to 4th subdivisions are for the corresponding regiments, the 5th for the artillery brigade, the 6th for the whole of the Divisional train and for the Divisional staff.

² Viz.: Supplies, kettles, treasury, office, field companion and medical appliances, veterinary field companion, tools, and materials for shoeing horses, for repair of train and harness, reserve of boots and Officers' baggage.

³ Apothecary's cart, sanitary cart, and cart for Commander of Divisional train.

⁴ Including 100 horses for the horse reserve of the Division.

⁵ The Commander of the Divisional train, Adjutant, official for correspondence, Commander of general section, and two Surgeons (one of them a Veterinary Surgeon).

Staff of the whole Train and General Section—continued.

| | Subdivisions of the General Section. | | | | | |
|--|--------------------------------------|------|------|------|------|------|
| | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. |
| Rank and file— | | | | | | |
| Sergeant-major and quartermaster sergeant ... | .. | .. | .. | .. | .. | 2 |
| Sectional N.C.O. | 1 | 1 | 1 | 1 | .. | 1 |
| Dressers, 5; clerks, 4; artificers, 10; for interior economy, 2. Total | .. | .. | .. | .. | .. | 21 |
| Train soldiers | 10 | 8 | 8 | 8 | 2 | 63 |

The Staff of the Divisional train and the general section thus comprises 433½ cwt. of baggage, 44 vehicles (including 3 two-wheeled carts), 244 horses, 3 Officers, 3 officials, and 127 rank and file.

(2.) Expense Transport.

| | Subdivisions. | | | | | |
|--|--|--------|---------|--------|--------|----------|
| | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. |
| (a.) Provision supplies of the troops of the Division | <div style="display: flex; justify-content: space-between;"> For 4,000 men for 1,500 men </div> in each subdivision. | | | | | |
| Biscuits and groats for 4 days, salt for 8 days, tea and sugar for 10 days; total weight | <div style="display: flex; justify-content: space-between;"> 351½ cwt. 132 cwt. </div> in each subdivision. | | | | | |
| (b.) Baggage of personnel of the transport ... | cwt. 5¾ | cwt. 2 | cwt. 5¾ | cwt. 2 | cwt. 1 | cwt. 29¼ |
| Total cwt. | 357¼ | 353½ | 357¼ | 353½ | 133 | 161¼ |
| Vehicles, 3-horsed | 31 | 31 | 31 | 31 | 12 | 14 |
| Horses—Draught | 93 | 93 | 93 | 93 | 36 | 42 |
| „ Spare | 9 | 9 | 9 | 9 | 4 | 4 |
| „ Riding | 2 | 1 | 2 | 1 | 1 | 5 |
| Officers and officials | 1 | .. | 1 | .. | .. | 3 |
| Rank and file— | | | | | | |
| Sergeant-major and quartermaster-sergeant.. | 1 | .. | 1 | .. | .. | 2 |
| Sectional N.C.O. | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 hospital dresser, 2 farriers, 3 clerks | .. | .. | .. | .. | .. | 6 |
| Privates for interior economy | 3 | .. | 3 | .. | .. | 4 |
| Artificers | 1 | 1 | 1 | 1 | 1 | 12 |
| Train soldiers | 35 | 35 | 35 | 35 | 14 | 16 |

Total of the expense transport: 1,718 cwt. of baggage, 150 vehicles, 506 horses, 4 Officers, 1 official, and 213 rank and file.

As has been explained, each pair of subdivisions is commanded by an Officer with the powers of a company commander. The Officers are borne on the strength of the 1st, 3rd, and 6th subdivisions, hence the difference in the weight of baggage, the number of men, and of riding horses, compared with the 2nd, 4th, and 5th subdivisions. The commanders of the 1st and 2nd, 3rd and 4th subdivisions have under their orders 78 rank and file, 62 vehicles, and 207 horses; the commander of the 5th and 6th subdivisions 57 rank and file, 26 vehicles, and 92 horses.

(3.) *Reserve Transport.*

| | Subdivisions. | | | | | |
|---|------------------------------|------|------|----------|----------|------|
| | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. |
| (a.) Similar provisions in similar quantity and for the same number of men as in the expense transport | 351½ cwt. | | | 132 cwt. | | |
| | in each subdivision. | | | | | |
| (b.) Three days' reserve of oats for the establishment of horses of the transport itself, to feed them on the way to the expense magazine and back (besides a 3 days' supply, which is laid down to be carried in each vehicle) | 36 cwt. in each subdivision. | | | 13 cwt. | 19¾ cwt. | |
| Baggage of the personnel..... | 6 | 2 | 6 | 2 | 1 | 31½ |
| Total cwt..... | 393½ | 389½ | 393½ | 389½ | 146 | 183¼ |
| Vehicles, 3-horsed..... | 34 | 34 | 34 | 34 | 13 | 16 |
| Horses—Draught | 102 | 102 | 102 | 102 | 39 | 48 |
| „ Spare..... | 10 | 10 | 10 | 10 | 4 | 4 |
| „ Riding..... | 2 | 1 | 2 | 1 | 1 | 6 |
| Officers and officials | 1 | .. | 1 | .. | .. | 4 |
| Rank and file— | | | | | | |
| Serjeant-major and 3 quartermaster sergeants | 1 | .. | 1 | .. | .. | 2 |
| Sectional N.C.O. | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 dresser, 2 farriers, 3 clerks | .. | .. | .. | .. | .. | 6 |
| Privates for interior economy | 3 | .. | 3 | .. | .. | 4 |
| Artificers..... | 1 | 1 | 1 | 1 | 1 | 12 |
| Train soldiers | 39 | 39 | 39 | 39 | 15 | 18 |

Total in the reserve transport baggage 1,895¼ cwt., vehicles 165, horses 556, Officers 4, officials 2, rank and file 232.

Command of subdivisions as in the expense transport.

(4.) *Total Divisional Train of an Infantry Division.*

| | Staff and general section. | Expense transport. | Reserve transport. | Total. |
|--------------------------|----------------------------------|-----------------------|-----------------------|--------|
| Field Officers | 1 | .. | .. | 1 |
| Officers | 2 | 4 | 4 | 10 |
| Surgeons | 1 | .. | .. | 1 |
| Veterinary Surgeons..... | 1 | .. | 1 | 2 |
| Officials | 1 | 1 | 1 | 3 |
| Total | 6 | 5 | 6 | 17 |
| Rank and file | 126 | 213 | 232 | 571 |
| Vehicles | 44 ¹ | 150 | 165 | 359 |
| Horses..... | 244 | 506 | 556 | 1306 |

The sanitary section is not included in this, as the establishments and tables, although ready, are not yet finally sanctioned. It consists of—

(a.) A Divisional lazaret of 3 two-wheeled carts, 15 two-horsed and 9 four-horsed (8 hospital *linéikas* and 1 large wagon for tents) wagons; total, 27 vehicles and 71 horses (including 2 riding horses).

(b.) Of two Divisional hospitals, each of 200 soldiers, and 10 Officers' beds. In both there are 4 carts, 36 pair-horsed and 4 four-horsed wagons; total, 44 vehicles and 100 horses (including 6 spare and 2 riding).

Consequently in the whole medical section there are 71 vehicles and 171 horses.

To give a concrete idea of the dimensions of the train and of the depth occupied by a whole infantry Division marching on one road, the following table is appended :—

| | Vehicles. | Horses. | Depth in paces. |
|---|----------------|---------|--------------------|
| I. <i>Troops and train of 1st line—</i> | | | |
| Leading battalion of 1st Regiment..... | .. | .. | 350 |
| Interval..... | .. | .. | 50 |
| First heavy battery, with all wagons, reserve carriage, and train of 1st line .. | 2 ² | 8 | 600 |
| Interval..... | .. | .. | 50 |
| Remaining 3 battalions of 1st Regiment (and two intervals of 50 paces each) ... | .. | .. | 1,200 |
| Interval..... | .. | .. | 25 |
| Train of 1st line of 1st Regiment | 23 | 40 | 150 |
| Interval..... | .. | .. | 100 |
| 2nd Regiment with train of 1st line, having the 2nd heavy battery with train of 1st line in rear of leading battalion.. | 25 | 48 | 2,425 |

¹ Including 3 two-wheeled carts.

² One hospital *linéika* and artillery wagon.

| | Vehicles. | Horses. | Depth in paces. |
|---|----------------|---------|-----------------------------|
| <i>Troops and train of 1st line, continued—</i> | | | |
| Interval between brigades | .. | .. | 200 |
| 3rd Regiment, with train of 1st line..... | 23 | 40 | 1,725 |
| Interval..... | .. | .. | 100 |
| Four light batteries with brigade staff and train of 1st line | 9 ¹ | 24 | 2,150 |
| Interval | .. | .. | 100 |
| 4th Regiment and train of 1st line..... | 23 | 40 | 1,725 |
| Total of Division and train of 1st line.... | 105 | 200 | 10,950 (5 miles) |
| II. <i>Interval according to regulation for the regimental train</i> | .. | .. | 500 |
| III. <i>Train of 2nd line—</i> | | | |
| Of Divisional Staff and of Commander of 1st Brigade (with interval of 25 paces) .. | 6 | 14 | 100 |
| Of 1st Regiment | 63 | 111 | 600 |
| Interval..... | .. | .. | 25 |
| Of 1st heavy battery | 7 | 16 | 90 |
| Interval..... | .. | .. | 25 |
| Of 2nd Regiment | 63 | 111 | 600 |
| Interval..... | .. | .. | 25 |
| Of 2nd heavy battery..... | 7 | 16 | 90 |
| Interval..... | .. | .. | 25 |
| Wagon of Commander of 2nd Brigade ... | 1 | 2 | 15 |
| Of 3rd Regiment..... | 63 | 111 | 600 |
| Interval..... | .. | .. | 25 |
| Of Staff of Artillery Brigade and of 4 light batteries..... | 33 | 74 | 400 |
| Interval..... | .. | .. | 25 |
| Of 4th Regiment..... | 63 | 111 | 600 |
| Total train of 2nd line of Infantry Divi- sion | 312 | 566 | 3,245 (over 1½ miles) |

Consequently a Division with all the regimental train will occupy in depth (infantry in sections or in fours, artillery in column of route, train in column of route, carts two abreast) $6\frac{2}{3}$ miles, and allowing for drawing out 10 miles, or half a day's march.

¹ The remaining 4 artillery wagons, and 1 *linéika* and 4 carts (viz., 2 pharmacy, 1 medical, and 1 cart for the Officer commanding the brigade).

| | Vehicles. | Horses. | Depth in paces. |
|---|-----------|---------|--|
| <i>IV. Order of March and Depth of Column of Divisional train—</i> | | | |
| Train of 3rd line— | | | |
| Divisional lazaret | 27 | 71 | 300 |
| Interval..... | .. | .. | 25 |
| Two Divisional hospitals (25 paces interval between them)..... | 44 | 100 | 550 |
| Interval..... | .. | .. | 25 |
| Staff and general section of Divisional train | 44 | 244 | 700 |
| Interval..... | .. | .. | 25 |
| Expense transport..... | 150 | 506 | 1,900 |
| Interval..... | .. | .. | 25 |
| Reserve transport | 165 | 556 | 2,100 |
| Total train of 3rd line of Infantry Division (Divisional train) | 430 | 1,477 | 5,650 (nearly 2 $\frac{3}{4}$ miles) |

Consequently an infantry Division with all its transport will occupy $9\frac{1}{2}$ miles in depth, if the train of 3rd line can follow immediately after the 2nd line, but on the march it will draw out to $14\frac{2}{3}$ miles, *i.e.*, a whole march. But the train of the 3rd line need not follow nearer than one day's march ; if it always marches a day in rear of its Division, this is more than is required on the march.

In the majority of cases the train of the 3rd line will be less than above given. In the first place the Divisional lazaret and one mobile hospital will be, when an action is impending, at the head of the train of the 2nd line, and sometimes in that of the 1st line. Secondly, the reserve transport may not be with the Division at all, and if it is, it will be so very rarely all together. The greater portion of it will be always engaged in transporting sick and wounded to the rear, or in bringing up supplies from the magazines. Both causes will diminish the depth of the train of the 3rd line of the Division by nearly 2 miles, *i.e.*, by nearly one-half ; while the depth of the train column of the 1st or 2nd line will be increased by the Divisional lazaret and one mobile hospital by only 600 paces.

II. *Divisional Train of a Cavalry Division.*

(1.) *Staff and General Section.*

(1.) Reserve of made-up clothing, 4 sets per squadron (none for a Cossack regiment), 4 per battery, and 10 for the whole Divisional train and Divisional Staff.

(2.) Made-up boots, 10 pairs per squadron (none for a Cossack regiment), 10 pairs per battery, and 20 for the whole Divisional train and Divisional staff.

(3.) Supply of horse-shoes and nails for 700 horses for each cuirassier regiment, for 1,000 horses for each dragoon and Cossack regiment, and for

² One special pair-horsed vehicle is allotted to the Ural body-guard sotnia in the Divisional train of this Division.

regiment for 600 men (53 cwt.) ; for other regiments for 900 men (79 cwt.) ; for a battery of 180 men (nearly 16 cwt.) ; and for the whole Divisional train and for the Divisional staff also for 180 men (nearly 16 cwt.). In addition to this the baggage of the personnel of the transport itself is 18 cwt.

To carry this baggage there are : for a cuirassier regiment, 7 pair-horsed vehicles ; in other regiments, 10 ; for a battery, 2 ; and for the whole Divisional train and Divisional staff, 4 pair-horsed vehicles. The personnel of the transport consists of a Commander (Captain or Staff Captain), official for correspondence, sergeant-major, quartermaster-sergeant, train non-commissioned officers in command of the regimental vehicles (according to the number of regiments of the Division), and 1 non-commissioned officer in charge of the vehicles of the batteries, of the Divisional staff, and of the whole Divisional train, 1 medical dresser, and 1 farrier, 2 clerks, 2 privates for purposes of interior economy, 5 artificers, and train soldiers according to the number of vehicles and horses. Total :—

| | Officers and officials. | Rank and file. | Vehicles. | Horses. |
|--|-------------------------------|-------------------|-----------|---------|
| In 1st Guard Cavalry Division | 2 | 84 | 58 | 137 |
| In 2nd " " Divisions | 2 | 99 | 72 | 167 |
| In 1st to 14th Cavalry Divisions | } 2 | 72 | 48 | 113 |
| In Caucasus Cavalry Division, in 1st and 2nd Caucasus and Don Cavalry Divi- sions, each..... | | | | |

3. *Total Divisional Train of a Cavalry Division.*

| | Officers and officials. | Rank and file. | Vehicles. | Horses. |
|--|-------------------------------|-------------------|-----------|---------|
| In 1st Guard Cavalry Division | 8 | 188 | 87 | 297 |
| In 2nd " " | 8 | 210 | 108 | 342 |
| In 1st to 14th Cavalry Divisions | 8 | 157 | 73 | 240 |
| In Caucasus Cavalry Division | 8 | 158 | 74 | 242 |
| In 1st and 2nd Caucasus and Don Cavalry Divisions | 8 | 154 | 70 | 234 |

There is no medical section laid down for the Caucasus Divisions.

The dimensions of the train and the depth of column is only given here for an army cavalry Division (being sufficient by way of example).

| | Vehicles. | Horses. | Depth in paces. |
|---|-----------|---------|-------------------------------|
| <i>I. Troops with train of 1st line.—</i> | | | |
| 1st Dragoon Regiment in threes..... | — | — | 1,330 |
| Interval | — | — | 25 |
| Train of 1st line ¹ | 16 | 88 | 190 |
| Interval | — | — | 50 |
| 1st Horse Battery in column of route, with 6 wagons and spare carriage, numbers in rear of guns | — | — | 400 |
| Interval | — | — | 25 |
| Train of 1st line | 3 | 20 | 45 |
| Interval | — | — | 100 |
| 2nd Dragoon Regiment with train of 1st line | 16 | 88 | 1,545 |
| Interval between brigades | — | — | 200 |
| 3rd Dragoon Regiment with train of 1st line | 16 | 88 | 1,545 |
| Interval | — | — | 50 |
| 2nd Horse Battery with train of 1st line .. | 3 | 20 | 470 |
| Interval | — | — | 100 |
| Cossack regiment | — | — | 1,330 |
| Interval | — | — | 25 |
| Train of 1st line | 16 | 61 | 165 |
| Total of Division with train of 1st line.. | 70 | 365 | 7,595 (3½ miles) |
| <i>II. Interval in accordance with regulations for regimental train</i> | | | |
| — | — | — | 500 |
| <i>III. Train of 2nd line of Divisional Staff and Commander of 1st Brigade.....</i> | | | |
| — | 9 | 19 | 110 |
| Interval | — | — | 25 |
| Of 1st Dragoon Regiment | 26 | 57 | 310 |
| Interval | — | — | 25 |
| Of 1st Horse Battery | 8 | 18 | 100 |
| Interval | — | — | 25 |
| Of 2nd Dragoon Regiment..... | 26 | 57 | 310 |
| Interval | — | — | 25 |
| Of Commander of 2nd Brigade..... | 1 | 2 | 15 |
| Of 3rd Dragoon Regiment | 26 | 57 | 310 |
| Interval | — | — | 25 |
| Of 2nd Horse Battery..... | 8 | 18 | 310 |
| Interval | — | — | 25 |
| Of Cossack regiment | 16 | 36 | 190 |
| Total train of 2nd line of Cavalry Division | 120 | 264 | 1,805 (nearly 1½ miles) |

Consequently a cavalry Division with all its regimental train will occupy a length of 9,900 paces, or nearly $4\frac{1}{4}$ miles, and when extended on the march as much as $6\frac{1}{3}$ miles.

¹ Pair-horsed vehicles in column of route, 2-wheeled carts two abreast, led riding horses in threes (with the men in charge between each pair of horses).

| | Vehicles. | Horses. | Depth in paces. |
|---|-----------|---------|-----------------|
| IV. <i>Train of 3rd line</i> (Divisional) one march in rear.— | | | |
| Staff of Divisional train and general section | 25 | 127 | 300 |
| Interval | — | — | 25 |
| Expense transport | 48 | 113 | 575 |
| Total train 3rd line | 73 | 240 | 900 |

i.e., rather more than $\frac{1}{2}$ mile, and when extended $\frac{2}{3}$ mile.

III. *Brigade Train of Rifle Brigade.*

(1.) *Staff and General Section.*

(1.) Intrenching tools : for each battalion, 40 shovels, 12 picks, 12 mat-tocks, 96 axes, and 4 crowbars.

(2.) Made-up clothing : 16 sets per battalion, and 4 for the brigade train.

(3.) Materials for the renewal and repair of clothing for each battalion and for the brigade train.

(4.) Made-up boots : 128 pairs per battalion, and 10 pairs per brigade train.

(5.) Materials and tools for repair of boots, only for brigade train, at the same rate as for a company.

(6.) Supply of horse-shoes and nails : for 50 horses for each battalion, for 250 horses for the brigade train.

(7.) Pack-saddle gear, Diterich's system : 11 pack-saddle sets per battalion, according to the number of pair-horsed carts.

(8.) Horse reserve of the brigade, consisting of 12 horses, with spare harness on half of them.

(9.) Baggage of the personnel of the staff of the brigade train and of the general section.

Total : $16\frac{3}{4}$ cwt. per battalion, and $23\frac{3}{4}$ cwt. for the brigade train. To carry this there are 2 pair-horsed vehicles per battalion, and 3 for the brigade train.

Total establishment : 1 Officer, 1 official for correspondence, 28 rank and file, 11 vehicles, 39 horses (including 12 forming the horse reserve of the brigade, 2 spare, and 3 riding).

(2.) *Expense Transport.*

Biscuit and groats for 4 days, salt for 8 days, tea and sugar for 10 days for 1,000 men for each battalion, and for 100 men of the brigade train. In addition to this there is the baggage of the personnel. Total : 88 cwt. per battalion, and $13\frac{3}{4}$ cwt. for the brigade train. To carry this there are 11 pair-horsed vehicles per battalion, and 2 for the Divisional train. Total establishment : 1 Officer, 59 rank and file, 46 vehicles, and 105 horses (including 8 spare and 5 riding).

(3.) *Reserve Transport.*

This transport is capable of conveying a similar quantity of provisions, and an additional 3 days' supply of oats for the horses of the transport itself, to

feed them on the way to the expense magazines and on the return journey. Total : 96 cwt. per battalion, and (together with the baggage of the personnel) 16 cwt. for the brigade train. To carry the above there are 12 two-wheel vehicles per battalion, and 2 for the brigade train. Total establishment : 1 Officer, 63 rank and file, 50 vehicles, and 113 horses (including 8 spare and 5 riding).

(4.) *Total Brigade Train of a Rifle Brigade.*

3 Officers, 1 official, 150 rank and file, 107 vehicles, and 257 horses.

This train will occupy a depth, with intervals, of nearly 1,000 paces, or $\frac{1}{2}$ mile, and when extended on the march, $\frac{2}{3}$ mile.

The remainder of the article contains details of the temporary organization of the regimental and Divisional trains, which will hold good pending the transformation from the present system to that above described ; but as these are of mere temporary interest, it is needless to give them here. The regulations published in August, 1885, give full particulars of the new organization, and the translator will be happy to answer any questions which those interested in the matter may desire to address to him.

NOTICES OF BOOKS.

Tactical Studies from the Franco-German War of 1870-71. By Captain F. G. STONE, R.A. Kegan Paul, London. 1886. Pp. 174. Size 9" x 6" x 1½". Weight 1 lb. 10 ozs. Price 30s.

The aspiration "Oh, that mine enemy would write a book," might be judiciously supplemented by "Oh, that my friend would *not* write a preface." A reviewer is supposed to be absolutely above personal considerations, and to praise or condemn the works of friends or foes with equal impartiality; but the task is sometimes difficult, and especially so in the present case, owing to old and pleasant associations between author and reviewer. With regard to the work now before us, it is the preface which is the difficulty confronting the reviewer. Were it not for the preface we should treat the work as we should any of its predecessors from other pens, merely as a well-meaning attempt to solve or throw a light on complicated and difficult tactical problems; but Captain Stone claims practically for his book a far higher place in the literature of the war of 1870-71.

The author states that he has had the advantage of a "mass of reading and accumulated experience, acquired by long and careful study of the subject under favourable conditions," and that he has "spared no pains to render his work a reliable and valuable source of information to the student of military art." The selection of the battles "has been made with a view to bringing prominently forward the conduct of great battles in modern times, under conditions which are in each case illustrative of the application of tactical principles to almost every conceivable situation in which a General or Staff Officer is likely to find himself placed."

Captain Stone, therefore, himself sets up a standard, and that a high one, by which his work is to be judged. It is the duty of the reviewer to ascertain how far, therefore, the "Tactical Studies" are a reliable and valuable source of information, and how far they can be of use not merely to "Students of the Tactical Branch," but also to the higher troop leaders.

Unfortunately, Captain Stone, in his desire to place before the student the results of his own studies in the "most condensed form possible," has carried the condensing process to such a pitch as to deprive the book of much of the possible value and usefulness it might otherwise possess.

The defect inherent in condensation is that too often facts when condensed become half facts; truths, half truths; and it is when condensing tactical facts that the defect is so fully apparent. The study of tactics is essentially a study of details. Omit the details and we obtain merely worthless and misleading generalities whether we are Generals or only subalterns, and the most valuable lessons escape our notice. And even strategy may suffer from the condensation process, as evidenced by the so-called "Diary" in the "Tactical Studies." The effect of this process of condensation, as carried out by Captain Stone, will be best judged by a comparison of some of Captain Stone's "condensed" facts with the uncondensed original matter, and this comparison will enable our readers to form an idea of the nature of the book, and an estimate of its value to themselves.

P. 3. Condensed facts. "The fortress of Bitsch resisted *all attempts*¹ on the part of the *German Army*, compelling the troops on that road to move round by indifferent bye-ways."

Uncondensed facts. On the 8th August a Bavarian H.A. Battery threw some incendiary shells into the town (Official Account, p. 259, Sec. 4). On 23rd August, four 12-pr. rifled guns fired on the fortress for two hours (O.A., pp. 459-60, Sec. 9). On 11th September commenced a four days' bombardment from some 28 guns (O.A., pp. 129, 130, Sec. 19), but beyond these attempts and a partial investment, the Germans made no effort to take the fortress.

¹ The italics are our own.

P. 12. Condensed fact. "MacMahon commenced his march *northward with the view of retreating on Paris.*"

Uncondensed fact. "He (MacMahon) resolved to retire in a north-westerly direction before the advance of the Crown Prince, and thus still be able either to reach Paris in good time by a *détour*, or *advance to meet Marshal Bazaine*" (O.A., p. 186, Sec. 7).

P. 16. Condensed fact. "MacMahon was fully aware of the German numbers and positions on the 21st, and his flank march was undertaken with a full knowledge of the risk incurred."

Uncondensed fact. "The Marshal was therefore at this time well informed; only with respect to the supposed propinquity of the IIIrd Army was he *deceived* by the German Cavalry appearing at Vitry, which was some days ahead of the Army" (O.A., note, p. 187, Sec. 7).

P. 16. Condensed fact. "The Army of the Meuse changed front, with the object of moving in a northerly direction."

Uncondensed fact. The Army of the Meuse changed front with the object of moving in a north-easterly direction, so as to anticipate the French Army about Damvillers (O.A., pp. 244-5, Sec. 7).

P. 16. Condensed fact. The Saxons and 1st Bavarians are spoken of as the Corps which attacked the 5th French Corps at Beaumont.

Uncondensed fact. The surprise was effected by the IVth Army Corps, which took as prominent a part in the battle as the two mentioned (O.A., pp. 245, *et seq.*, Sec. 7).

Let us now turn to the effect of the condensation on the descriptions of the battles, and we will select Spicheren as an illustration. In $4\frac{1}{2}$ pages of wide-spaced print, with deep margins, are condensed the forty closely printed pages of the German Official Account of the Battle of Spicheren. Captain Stone rarely deals in this battle with a unit less than a brigade, which in the German Army numbers six battalions of four companies each, three battalions forming a regiment. What is the result? At p. 42 we read that at 2.30 P.M. the 27th Brigade reached the edge of the Gifert Wald, but from the details given, p. 215, Sec. 3, O.A., we find that the only troops of the brigade which were at the edge were the 2nd, 3rd, 5th, and 7th, and possibly the 6th Company of the 39th Regiment. "At the same time the right wing occupied Drathzug." The right wing of what? Certainly not that of the 27th Brigade, which was well into the Stiring Copse. But the full effect of condensing tactics will be best illustrated by the comparison given below. At p. 215, O.A., we read the following account of General v. François' advance to the Rotherberg:—

"Shortly after one o'clock General v. François led thither in person the two battalions of the 74th from the drill ground. To support this movement the three batteries were brought forward from the Winterberg to the Galgenberg. Although within the range of the enemy's musketry, they directed their fire on the troops on the Spicheren heights." . . . "He (the Officer commanding the leading battalion) deemed a direct ascent of the steep and rocky slopes impracticable without a corresponding flanking movement. Restraining the attempts of some of the more foolhardy, he ordered every man to get under cover below *the heights*, at the same time keeping up but a moderate fire upon the enemy's riflemen perched above them. As the enemy swept the *entire foot of the heights from his shelter-trenches*, which lined the edge of the precipice, cover was only to be obtained by crouching under *the rocky walls*. Meanwhile General v. François had returned to the 1st Battalion, which was following the Fusiliers at some little distance, and overlapping them on the right. It will be remembered that in consequence of intelligence from the right wing, the General had ordered the 1st and 2nd Companies into the Stiring Copse, and that the 3rd Company was also employed there, and partly towards the high road. The 4th Company had also been originally assigned a south-westerly direction; it afterwards received a contrary order to move towards the east side of the Rotherberg, with a view to supporting the *débouch* from the Gifert Forest. Without much loss the company reached the north-west corner of that forest, where it found protection against the enemy's projectiles under one of the *natural projecting terraces*, and took up the connection on the left with the 6th Company 39th Regiment; the 4th Company of the latter regiment, belonging

to the battalion in the Stiring Copse, which had just arrived on the drill ground, was also brought up towards the Rotherberg."

Now let us turn to the condensed account. "Soon after 1 P.M., General v. François led forward the remainder of the 27th Brigade to storm the Rotherberg; the fire of the French was, however, so severe that v. François was obliged to halt his force close under the heights, where it was under cover, owing to the *dense woods* which clothed the steep hill sides; the *lower edge of these woods* was not occupied by the French."

Let our readers compare the above, and they will admit that, even putting aside the substitution of dense woods for rocky terraces, we lose the whole point of the episode of the battle as teaching for Generals and Staff Officers, namely, the difficulty of leading under fire even two battalions to a decisive point in a battle-field.

As another example in the same battle we may take Captain Stone's treatment of the 28th Brigade. This brigade he treats as a whole; he never disintegrates it; and thus we lose one of the most valuable lessons of the battle. From pages 216, *et seq.*, of the Official Account, we collect the following details of the leading of the brigade.

The brigade was only five battalions strong. General v. Woyna, the brigadier, led his brigade from the railway bridge (not where the 27th Brigade crossed) by both sides of the railway towards the left of the French position, and then resolved to move against the enemy's left flank. With him went through the Stiring Forest the leading battalion, 1st, 53rd Regiment. The next battalion followed this movement with some difficulty through the thick underwood, *gradually losing contact with the leading battalion*. Half of the third battalion, 2nd and 3rd Companies, 77th, continued the turning movement with difficulty in the thick underwood; the other two companies went direct to the front along the railway. The fourth battalion, 2nd, 77th, was requested by an Officer they met to go to the Stiring Copse immediately in front of them, and they did so; whilst the rear battalion, for a similar reason, went away well off to the left, to the Golden Bremm and Baraque Mouton. Generals and Staff Officers can not only learn a good deal about the difficulties of leading in wooded ground from the above account, but they will fully sympathize with poor General v. Woyna, when somewhere about 5 P.M. he determined to withdraw his solitary battalion for the purpose of *first regaining the connection with the rest of the brigade*, and we are told at p. 220, "He was ignorant, however, of the fact that the latter had meanwhile been otherwise employed."

Of the remarkable, almost inexplicable, and sudden collapse of the French when apparently on the road to success on their left, at about 7 P.M., Captain Stone takes no notice, nor more than casually of the turning movement and attack on Forbach. The numbers he assigns to the Germans at the close of the battle are 50,000 men and 120 guns, whereas only 27 battalions, each certainly not above 900 strong, and 9 batteries, alone took part in the battle.

The battles of Wörth and Mars-la-Tour, which we have also examined, both suffer similarly; but the instances adduced are sufficient to illustrate the character of the work.

As regards giving a clear sequence of the events of the battle-field, we fail to see that Captain Stone has arrived at this desirable result. Of badly compiled accounts of battles, that of Wörth in the Official Account, is a glaring example, utterly unworthy of the German Staff, but Captain Stone has followed their lead in the treatment of the battle; and, further, in his narrative he has made the grave error of placing at 1 P.M. the XIth Corps round Gunstett and Spachbach. His own sketch (VI), which is a copy of the sketch opposite p. 178 (see Official Account), contradicts this statement, and this position is an important feature in the tactics of the battle. Numerous errata are there also in this work. The 2nd Cavalry Division did not take part in the Battle of Colombey, p. 10. There is no such unit as the 21st Brigade, VIth Army Corps, p. 24; nor as the 20th Cavalry Division shown at Tronville on the sketch of Mars-la-Tour 4 P.M.; neither does the 1st Battery of the 39th German Regiment exist, p. 50. We do not purpose dealing with the Donnybrooks of Gravelotte or Sedan, nor with Captain Stone's narratives and comments. We have no wish to be in the slightest degree sarcastic, when we say that for military or civilian readers who wish for a mere skeleton of the battles, and who are not particular about accuracy, and such readers of military

history are not a few, the book will be found of value; but for the classes for whom it is intended we doubt it will be of much use.—L. A. H.

Outlines of Military History. By Colonel O. R. MIDDLETON, K.O.R.L. Regiment. Mitchell, London. Pp. 323. Size 9" × 6" × 1½". Weight under 2 lbs. 6 ozs. Price 21s.

The author gives in this work "a concise account of the principal campaigns in Europe between the years 1840 and 1870, being those generally referred to in our military text-books."

Unlike the author whose work has just been noticed, Colonel Middleton in his preface disarms criticism; for he says, "In the following pages, the movements of the troops in the several campaigns under consideration are given in as concise a form as possible, and are not at all times *positively accurate*, but it is thought that they are sufficiently so to give a general idea of the strategy."

A writer on military history cannot expect that much confidence will be placed in him, or that much value will be attached to his work, when the first requirement of historical narrative, viz., accuracy, is avowedly absent. It would be no good for us to point out any inaccuracies in the work, such as exist even in the first 10 out of the 14 lines on the last page, for the reader would point to the words quoted from the preface. Still it takes away one's breath to read there that "after the capitulation of Metz, the 2nd Army was moved to Troyes, also to assist in covering the communications of the Germans; whilst the 1st Army occupied Metz and besieged some of the smaller fortresses. The French Army of the Loire consisted of upwards of 200,000 men. By December 18th (*sic*) they were completely broken up and driven into Switzerland." Shades of the Red Prince, v. Goeben, v. Werder, and v. Manteuffel, listen to this condensation of your triumphs! It is, however, very much to be regretted that so much labour, trouble, and expense, the latter as evidenced by the numerous maps and the way the book is got up, should have been spent to so little purpose.—L. A. H.

Burma, after the Conquest. By GRATTAN GEARY. Sampson Low, 1886. Pp. 345. Size 8" × 5½" × 1". Weight under 1 lb. 6 ozs. Price 7s. 6d.

The author of this very interesting work is the editor of the "Bombay Gazette." The conditions of the problem how to deal with Burma after the conquest could be best examined on the spot; and in order to learn the wishes and capabilities of the Burmese of the Upper Country and to learn about them, Mr. Geary went himself to Burma in December of last year. The tone of the book is moderate to a degree, and the work will repay careful perusal.

Exterior Ballistics of the Plane of Fire. By JAMES M. INGALLS, Captain 1st Artillery, U.S. Army Instructor. Van Nostrand, New York, 1866. Pp. 173. Size 9" × 6" × ¾". Weight under 1 lb. 6 ozs.

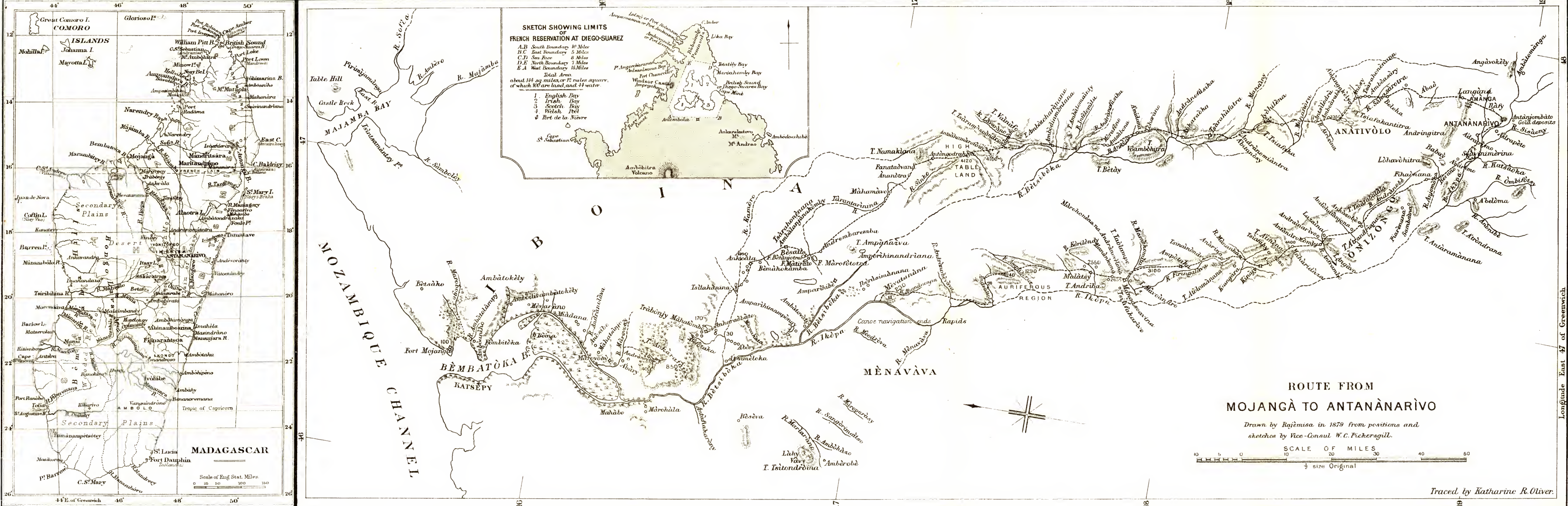
This work is intended primarily as a text-book for the use of the Officers under instruction at the U.S. Artillery School. The aim has been to present in one volume the various methods for calculating range tables and solving important problems relating to trajectories, which are in vogue at the present day, developed from the same point of view and with a uniform notation.

History of Gustavus Adolphus. By JOHN L. STEVENS. Bentley, London, 1885. Pp. 427. Size 9" × 6" × 1¾". Weight under 2 lbs. 2 ozs. Price 15s.

The author of this work was recently U.S. Minister at Stockholm, and he has read and carefully considered whatever might throw light on the character and career of Gustavus Adolphus. The volume is the result of his study of the best Swedish, German, French, and English writers on the subject and of conversations with Swedish scholars and statesmen.

India Revisited. By EDWIN ARNOLD. Trübner, London, 1886. Pp. 324. Size 7½" × 5½" × 1¼". Weight under 1 lb. 10 ozs. Price 7s. 6d.

This book is a diary and little more of a revisit to India. It is pleasantly and chattily written.





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VICE-ADMIRAL W. GORE JONES, C.B., in the Chair.

FRENCH OPERATIONS IN MADAGASCAR, 1883-1885.

By Captain S. PASFIELD OLIVER, late R.A., F.R.G.S., &c.

NOTE.

The Editor has been requested by Lieut.-Col. Jelf, R.E., to state that in the discussion on Major Beresford's Paper on "Field Telegraphs," on 9th April, 1886, he inadvertently mentioned the *Welsh Regiment* as having sent him a useless Telegrapher in Bechuanand; it was another Regiment altogether.

to enforce these historic rights, which had certainly been often reaffirmed although never exercised by successive French Ministers; and accordingly Commandant (now Admiral) Le Timbre was instructed to enforce this resolution by cutting down the national flags erected at certain positions within easy access from Nòsy Bé.

These orders were duly carried out by M. le Timbre in 1882, whereupon an embassy was despatched to Europe from Imèrina to protest against such proceedings, at Paris, London, and other capitals. Nevertheless the French claims were pressed, and, as the Malagasy Government refused to yield, the Minister of Marine,² under M. Jules

¹ "Examples of Military Operations in Madagascar by Foreign Powers, and Native Campaigns, 1643-1881" ("Journal of the Royal United Service Institution," No. CXXXII, vol. xxix, 1885).

² The final instructions issued by M. Chas. Brun, the Minister for Marine, to Admiral Pierre, on the 17th March, were to the following effect:—

"You will destroy the posts established by the Hóvas on those parts of the coast under our protection or sovereignty, comprehending not only that part of the north-west coast to the north of Ibòina, but also the north-east coast as far as Antongil Bay. You will cause the evacuation of any posts existing in this region, notably that of Antsingy (Bay of Diego-Suarez). You will then make a demonstration along the north-west coast and in Antongil Bay to confirm the intention of the Republic to maintain its rights over the whole extent of their territory. (2.) You

Ferry's direction, instructed Admiral Pierre to bring the Hóvas to terms by force of arms, and the Admiral proceeded in the cruizer "Beautemps-Beaupré" to put the orders into execution.

The Cabinet of M. Ferry seems to have been badly informed as to the nature of the conflict now entered upon with such a light heart. It appears to have been taken for granted that either the Malagasy would at once have yielded to all the French demands at the first exhibition of strength by the French men-of-war, or, that failing, a leisurely advance of a few hundred men could be made on the capital, only some seventy odd miles from the east coast, when the Hóva Government would immediately have collapsed, and the great island have changed hands and become French territory.

Consequently the only provision made for eventualities was the assemblage of a small land force sufficient, as it was supposed, to hold possession of the two principal ports, Mojangà and Tamatave, after they had been taken by the naval division. For this purpose, therefore, three companies were made up at Réunion,¹ from the small garrison there, mobilized and held in readiness to embark; whilst half a company of marine infantry was despatched to Nòsy-Bé, which island afforded a convenient base of operations on the north-west coast. Here also a few ships' guns were mounted in the small fort for the better protection of the town of Hellville.

The fighting strength of the Hóva army was estimated by the late Mr. Cameron about this period at some 20,000 well-drilled troops, partly armed with breech-loaders, and a horde of some 50,000 spearmen.

30th April, 1883.—Admiral Pierre's squadron assembled off Hellville in Nôsy-Bé on the 30th April, and consisted of—

| | |
|--|-------------------------------|
| "Flore," cruiser (1st class) | 20 guns, flag-ship. |
| "Forfait," " | 15 5½-in., 6½-in. guns. |
| "Beautemps-Beaupré," cruiser (3rd class) | 6 5½-in., 6½-in. guns. |
| "Vaudreuil," " | 6 3½-in., 6½-in., 4-in. guns. |
| "Boursaint," aviso (1st class) | 4 5½-in. guns. |
| "Pique," gunboat | 3 5½-in. guns. |

will possess yourself of the custom-house of Mojangà, and leave there a sufficient garrison from Nòsy-Bé as well as a ship. You will then promptly proceed with your squadron to Tamatave to act in concert with the Commissioner (M. Baudais). An ultimatum is to be sent to the Prime Minister, exacting: (1.) The effective recognition of the rights of sovereignty or protectorate which we possess on the north coast. (2.) The immediate guarantees necessary to secure the observation of the Treaty of 1868. (3.) The payment of indemnities due to French subjects.

"A term will be assigned to the Hóva Government, which will be warned that if its answer does not arrive within the date fixed upon, the Admiral will occupy the fort of Tamatave, seize the custom-house, and collect the duties until further orders. You will carry out, if occasion requires, the rigorous measures laid down in the summons."

Similar instructions were despatched by M. Challemel-Lacour to M. Baudais. (See "The True Story of the French Dispute in Madagascar," 1885, p. 112.)

¹ The headquarters of the French naval and military forces in the Indian Ocean are at Réunion, whose ordinary military establishment consists of four companies of marine infantry, one company of gendarmerie, and half a battery of artillery, in all some 550 men of the regular forces. From this garrison detachments are furnished to St. Marie and Nôsy-Bé as required. Hitherto there has been no garrison stationed at Mayotta. ("Les Colonies Françaises," Ministère de la Marine, 1883.)

7th May.—After embarking half a company of marine infantry, Admiral Pierre sent on the “Forfait” to Tamatave, and proceeded with the remainder of his squadron to Ampàsindàva Bay on the 7th May, where his vessels commenced hostilities—without any previous declaration of war—by destroying the Hóva posts at Ambòdimadiro, Ampàsimbitika.¹

At Anòrontsànga, on the west side of the Bàvatòby peninsula, some slight show of resistance was encountered, but elsewhere the Hóvas retired inland on the approach of the French vessels.

On the 15th the Admiral arrived before Mojangà at the entrance of Bèmbatòka Bay. This place was defended by three forts containing thirty pieces of ordnance, all of which were old iron pieces of no value. At the time of the French attack it held a garrison, according to report, of 2,000 men.

Admiral Pierre at once summoned the Governor to surrender, but at nightfall received a derisive reply.

At daybreak on the 16th the ships opened fire from their moorings at 1,700 yards from the shore. The batteries replied with a few shots, but were speedily silenced, and at 8 A.M., the Hóva camp being in flames, the French ceased firing. The Hóvas lost 38 killed, and then retired towards Mèvatanàna before 11 P.M., when a large conflagration broke out at several points of the town and destroyed the Hóva quarter. A landing was effected the next morning under cover of the ships’ guns, and the place occupied and placed in a state of defence. A detachment of marine infantry was landed and established a garrison under the command of Captain Gaillard of the “Vaudreuil,” which vessel was left to assist in the defence of the post.

The remainder of the squadron then proceeded to Tamatave, where Admiral Pierre arrived on the 31st May.

The news of the destruction and occupation of Mojangà reached Antanànarivo on the 24th May, causing a panic. All French subjects resident in the interior provinces were ordered to leave the country, and were given five days to prepare for their departure, after which delay an escort and bearers were furnished by the Government to convey them safely to the coast. There is no doubt that had Admiral Pierre been able to land a strong column up the River Ikòpa immediately after the bombardment of Mojangà, a force of from 8,000 to 10,000 men could have marched through Vonizongo into Imèrina with comparative ease.

1st June.—On the 1st June an ultimatum was forwarded to the Hóva Government imposing certain conditions which were to be accepted by midnight on the 9th June, after which date, failing a satisfactory reply, Tamatave would be bombarded.

The three marine companies, made up from the Réunion garrison with some gunners, arrived now in the transport “Nièvre,” and the

¹ *Vide* “French Operations in Madagascar, 1882-1886.” Prepared in the Intelligence Branch, War Office, by Major W. S. Cooke, Cheshire Regiment. D.A.Q.M.G., February, 1886.

N.B.—Major Cooke’s valuable compilation has been followed closely throughout in the lecture.

transport "Creuse" returning home with troops from Cochin was stopped at Tamatave¹ to assist in the operations.

At this time H.M.S. "Dryad,"² Commander Johnstone, was at Tamatave, and twenty marines were landed from her and placed as a guard to the Consulate under Lieutenant Knowles, R.N. The whole of the British subjects, excepting the Consulate staff and guard, embarked on board the "Dryad" and merchant ships in the roads, to the number of some 300, mostly coloured persons, only ten being Europeans.

10th June.—In the evening of the 9th the ultimatum was formally rejected, and the French Consul went on board the "Forfait." During the night the "Nièvre" shifted her position from among the other shipping, and anchored off the southern reef, half a mile away from Hastie Point, with a view to bringing a cross fire to bear on the fort.

At 6.30 A.M. on the 10th a signal shot was fired from the "Boursaint," and a regular fire opened from the whole French squadron, viz., "Flore," "Forfait," "Beautemps-Beaupré," "Boursaint," "Creuse," and "Nièvre," commencing with the "Flore," each vessel firing a shot every two minutes for the first half hour. The belt of trees along the shore masked the fort, situated a little to the north of and apart from the town, and somewhat impeded the effect of the French fire. The *enceinte* consists of a thick wall of masonry surrounded by a strong earthwork, but had only a few old-fashioned guns, which were not even mounted.

From the ships little beyond the top of the flagstaff could be seen. The town was soon in flames, the work, as Captain Johnstone supposed, of incendiaries.

No reply was made by the fort, which was evacuated immediately after the commencement of the bombardment, the garrison, reported at about 500 men, armed with Sniders, retiring to an entrenched

¹ *Tamatave*.—In Admiral De Horsey's remarks on Tamatave (see "African Pilot," Part III), he writes:—

"There is a white sandy beach all along the shore which, however, shows best south of Tamatave.

"The anchorage is protected by a reef projecting half a mile to the north-east and eastward, and a quarter of a mile to the south of Point Hastie, and also by a detached reef to the N.N.E. of the one just mentioned, leaving a clear channel of about one-third of a mile with from 9 to 14 fathoms of water in it. There is deep water anchorage outside these reefs in case of being becalmed, but the bottom is rocky, and the ground swell frequently heavy. The anchorage is in from 11 to 3 fathoms, shoaling quickly as you approach the shore. In all ordinary weather it is safe and smooth, but in a hurricane or common gale it would be insecure, as the holding ground is not good, and a heavy swell would roll in.

"To the northward of the Point Tanisa (or Tanio) it runs off shoal, beyond which spit there is a good passage between it and the north reef.

"The town is large, probably containing 10,000 inhabitants. It is pretty well supplied with wells, but the water is of indifferent quality, and not convenient for watering ship. The landing place is quite smooth inside the south reef. Boats may, however, land all round the bay, as there is but little surf. The fort is situated about half a mile north-west of the spit, and has a small outwork, both concealed by the trees."

² The unfortunate friction between the French Admiral and the English Com-

camp situated about 3 miles inland, and named Manjàkandrian-ombàna.

Till 8.15 firing was maintained at the rate of one shot every five minutes, after which it was slackened to one round every hour, and later continued at longer intervals throughout the day, being directed principally against the camp to which the Hóvas had retired.

11th June.—At daybreak on the 11th, under cover of the guns in the ships, a force of 600 men was landed, under command of Captain Billard, of the "Flore," and divided into three columns, advanced by the north beach, the main street of the town, and the outskirts of the village, on the fort, which was occupied in about half an hour without any opposition. Measures were at once taken to place the work in a proper state of defence.

12th June.—On the 12th the "Nièvre" and "Forfait" bombarded Ivondrona, a small village at the mouth of a river a few miles south of Tamatave, while the "Boursaint" and "Beautemps-Beaupré" bombarded Foule Point, Mahàmbo, and Fendàrivo to the north.

14th June.—On the 14th the refugees had returned to Tamatave from on board ship, and Admiral Pierre hoisted the French flag, proclaiming a state of siege, with Captain Billard, of the "Flore," as Commandant. The garrison and working parties from the squadron were busily employed in strengthening the defences of the place, mounting guns from the ships, and retaining a garrison of 400 men on shore, from which outposts were furnished for the protection of the town and peninsula. Access to Tamatave was denied to all foreign sailors, soldiers, and Officers.

26th June, 5th and 15th July.—Night attacks were made by the Hóvas on the French position at Tamatave, but though some bands succeeded in penetrating into the town, which they endeavoured to fire, they were on every occasion repulsed by the outposts with loss. The French reported their own loss at one killed and no wounded. Meanwhile they worked unremittingly at the strengthening their defences, and blockhouses were erected for the protection of the outposts and pickets.

The relative position of the opposing forces at Tamatave remained unchanged throughout the remainder of the war. The French, not having sufficient force to carry on operations inland, improved their lines of defence, while the Hóvas, on their side, continued to strengthen and enlarge their fortified position at Manjàkandrian-ombàna.

"The French," writes Colonel Shervinton, "remained inactive with the exception of occasional reconnaissances from Tamatave and Mojangà. These skirmishes were good schoolings for the Hóvas, who grew bolder day by day, and at last took to laying ambushes, into which the French often fell; and there were many trophies, including rifles, a horse, mules, an ambulance cart, &c., which found their way

mander, and the incidents in connection therewith, need only a passing allusion. It is merely sufficient to state that the conduct of the Commander met with the fullest approval from the Admiralty, and Captain Johnstone obtained his post rank in acknowledgment of his services.

up to the capital. The Hóvas also succeeded in capturing several prisoners who were well cared for in the Malagasy camp.”—(*MS. account of the late French campaign.*)

August.—In August four companies of marine infantry and a company of marine fusiliers (in all some 700 men) were ordered from France, and embarked in the “Creuse” and “Naiade,” the latter being the new flag-ship, to replace the “Flore,” ordered home; this reinforcement it was anticipated would enable the French to keep the Hóvas at a distance and prevent them from surrounding the town on the land side.

By the direction of Admiral Pierre a native auxiliary corps was ordered to be formed at Mojangà, of Sàkalàva and Ankàrana tribesmen, the subjects of Queen Benào and Tsialàna, the Chief of Nòsy Mitsio. Admiral Pierre was invalided home, leaving Captain Rallier in charge of the operations, and died on arrival at Marseilles, whilst in quarantine, 11th September.

September.—In September two companies of Créole volunteers were formed at Réunion, for service in Madagascar, but the enrolment progressed slowly, the service being distasteful, and the anticipated effective was never attained.

During September the British squadron, under Admiral Sir William Hewett, on the Mozambique coast, consisted of the following:—

“Euryalus,” flag-ship; “Briton;” “Tourmaline,” in relief of the “Dryad;” “Ranger;” “Osprey,” screw sloop; “Dragon;” “Undine,” schooner.

Difficulties arose with the local Malagasy authorities on the coast relative to the purchase of supplies, originating mainly from the inability of the inhabitants to distinguish between French and English war vessels, and from the harassing state of affairs produced by the French occupation.

Admiral Galiber hoisted his flag on board the “Naiade” at Tamatave on the 24th September, and the arrival of the new Commander-in-Chief, coupled with the departure of Captains Billard and Rallier, who had formed under Admiral Pierre a *régime* especially hostile to the British, soon led to the establishment of more amicable relations between the two European flags in the Indian Ocean.¹

October.—Negotiations were opened at Tamatave at the end of October, but no suspension of hostilities took place; and Commander Boutet proceeded with the “Boursaint” along the coast to the north, with instructions to do all the damage possible, which he carried out effectually by shelling various ports, as Foule Point, Mahàbo, Point Larée, Mānanàra, Maròantsètra, and other places in Antongil Bay.

¹ Admiral Galiber established three posts to guard the peninsula of Tamatave, each consisting of a blockhouse, situated on an elevation, capable of holding twenty-five men in the basement and twenty-five in the story above. These posts were completely surrounded with palisades and ditches planted with prickly pear. Next to the cactus fence were planted pickets with wire entanglements. Outside these posts, at 100 metres beyond the first line, were abattis of timber, and at 200 metres beyond another line of abattis, the whole surrounded with fougasses and ground torpedoes, electrically connected with the interior of the blockhouses, the whole defence rendering the place impregnable to any enemy unprovided with guns.

On the 31st October the "Boursaint" opened fire on the town and custom-house at Vòhimàro, where four natives were killed; then landing parties in two launches set fire to the houses not destroyed by the bombardment. The British subjects, Créoles and Indians, were taken to Tamatave.

On the 24th October the "Creuse" transport, with a company of 177 marine fusiliers, and the "Capricorne," a gunboat of light draught, arrived at Tamatave, and the former was fitted as a floating hospital. A considerable number of invalids were taken in the "Nièvre" to Réunion, where there is an excellent sanatorium at Salazie, for the French troops now began to suffer heavily from malarious fever.

These operations were followed on the 12th November by the bombardment of Mâhanôro by the "Nièvre" and "Vaudreuil." The "Boursaint" and "Beautemps-Beaupré" proceeded about the same time to Port Choiseul, beyond the bar of which the Hóvas had constructed a series of barriers to obstruct the approach, but these failed to stop the French boats, and the village was taken and burnt, the only casualty on the French side being a Malagasy pilot wounded.

The "Vaudreuil" and "Nièvre" went down the coast to the south and bombarded Mahéla, Mânanjàra, and Fort Dauphin.

On the 16th November an attempt was made by the Hóvas to carry off the Queen of the Sàkalàva from Mojangà, but was frustrated by the garrison, assisted by the fire of the gunboat "Pique" and a landing party from the "Forfait."

During the month of November two companies of Réunion volunteers arrived in Madagascar, and were distributed between Tamatave and Mojangà.

The French force on shore at this period is stated to have consisted of about 850 men, distributed as follows:—

| | | |
|------------------------|---|--|
| TAMATAVE. | { | Marine infantry, 3 companies, |
| | | Marine fusiliers, 1 company, |
| | | Marine artillery, detachment, and 4 guns, ¹ |
| | | Réunion volunteers, 1 company, |
| | | Landing companies from the Fleet. |
| MOJANGÀ. | { | Marine infantry, $\frac{1}{2}$ company, |
| | | Réunion volunteers, 1 company, |
| | | Sàkalàva auxiliaries, 1 company. |
| ST. MARIE and Nòsy-Bé. | | Marine infantry, $\frac{1}{2}$ company. |

At Réunion were four companies of marine infantry, between whom and the troops in Madagascar frequent reliefs were carried out.

On the 31st December another attack on the French position at Mojangà was repulsed without difficulty by the "Pique" and "Forfait" in conjunction with the garrison.

3rd January, 1884.—Operations in 1884 were opened by the bombardment by the "Boursaint," on the 3rd of January, of a village beyond Tanio Point, immediately to the north of Tamatave.

9th January.—Lieutenant-Colonel Willoughby, an Officer who had

¹ Besides guns and machine-guns from the men-of-war.

batòka Bay and the neighbouring bays; but this, he states, was insignificant, judging from its results, for, as he told the Committee, the commerce there is unimportant, all the foreign trade being in the hands of four or five English houses, one German, and two or three American firms established at Tamatave.

May.—In May Admiral Miot proclaimed a blockade of certain ports on the east coast, including Mâhanòro and Fènoarivo, in consequence of which the principal outlet for native produce and inlet for foreign goods was shifted to Vatomàndry.

Negotiations were again resumed and broken off in consequence of the French persisting in claims to possession of all North Madagascar beyond a line drawn from Cape Bellone to Cape St. Andrew.

28th June.—On the 28th June the French troops at Tamatave made a *reconnaissance en force* against the Hóva lines of Manjàkandrianombàna. The French force was reported to be 1,200 strong, with six field-guns and three mitrailleuses. The attack commenced at 6 A.M., but was met by a well-sustained fire from the Malagasy troops on the other side of the river, which prevented the passage, and the skirmishers fell back under cover of the guns. The Malagasy artillery, having the exact range, opened fire, and succeeded in silencing the French guns. After two hours the French retired. The Malagasy troops, who were said to be 10,000 strong, were commanded by General Willoughby, under whose lead they appear to have behaved admirably, and gained a complete success. They lost several men wounded, but no killed. The French admitted no loss on their side.

30th June.—On the 30th June another reconnaissance was made over the same ground, and an outpost south of the entrenched camp was attacked, but the French ultimately withdrew without pushing the assault home. The Hóva camp, surrounded by marshy and difficult ground, necessitating a circuitous line of approach, and strongly entrenched by the Malagasy, presented such difficulties to an attack, that Admiral Miot did not think his force sufficiently strong to carry it.

According to report, the Hóva works were extensive and scientifically constructed, armed with several field-guns and four or five machine-guns of their own manufacture. We have since learnt that ammunition was deficient to an alarming extent.

The French landed during July some 80 or 90 mules from Réunion, and a 5½-inch gun was mounted in the fort at Tamatave, which occasionally fired a few rounds into the Hóva camp.

Captain Laguerre, commanding the battalion of marine fusiliers, was in command of the troops on shore at Tamatave.

5th July, 1884.—The plain which environs Tamatave is in the shape of a trapezium, of which one face is formed by the sea, and the others by various river lines, which completely enclose it, viz.: (1) the Ivòndrona, which flows into the sea 7 miles south of Tamatave, opposite the outlying Fong Islands, where there is an important village, Anjòlokèfa, the first stage towards Antanànarivo; (2) the Vòrina, an affluent of the Ivòndrona; (3) the Sangàlatra, an affluent of the Vòrina; (4) the Tètezampàsy, which flows into the

Ranomainty, which in its turn joins (5) the Ivolòina which flows into the sea 8 miles north of Tanio Point.

This trapezium may be about 10 miles long from north to south and 4 miles wide from east to west.

This plain is extremely diversified and broken, being covered in many places with trees and brushwood and intersected with several streams and lesser brooks. Next the sea face it is bordered with sand hills covered with pandanus and convolvulus, within which hills are numerous marshes some of which are of considerable depth. From a military point of view the ground is exceedingly difficult.

The Hóvas took up a well chosen position along the line of rivers above enumerated which they judiciously entrenched.

The camp of Manjàkandrianombàna is situated on a hill $4\frac{1}{3}$ miles in a straight line inland from Tamatave, and is strongly palisaded and provided with batteries. To the right and left on both sides of the covering river line they established other posts on well selected sites so as to completely close the plain; and thus the peninsula on which Tamatave stands was completely enveloped by lines of circumvallation.

Sàhamàfy is a point on the Sangàlatra, 4 miles to the south of Manjàkandrianombàna; and at this date, 5th July, Admiral Miot wrote:—

“*Les Hóvas accumulent à Fàrafàtra des ouvrages en terre auxquels ils travaillent paisiblement depuis une année.*” . . . “Colonel Willoughby is among them with 5,000 men, it is said, and doubtless directs the construction of the redoubts which they raise at different points along their line. The situation which the Hóvas occupy on the hills of Fàrafàtra is not a mere rallying point (*rassemblement*), it is a line of frontier protected at each extremity by rivers of considerable depth, with its front covered by a series of marshes, streams, and rivers, which must be crossed in coming from Tamatave.

“The villages of the Bètsimisàraka are established in rear of this line under the surveillance of the Hóvas. They it is who excavate the ditches, who do all the hard work and bring in provisions.

“Whenever we shall drive the Hóvas from this line, they will fall back on the hill-spurs behind them with the same villages and we shall have to occupy one or two principal points to prevent them from returning.”

With regard to Mojangà,¹ at this time the Admiral wrote:—

“I think with you that it is important to occupy Màrovoày in Bèmbatòka Bay, but it is no use denying that the Hóvas have, like ourselves, appreciated the importance of this situation, which commands the route to Antànanarivo, and there-

¹ “The point at the west of the entrance to Bèmbatòka Bay is 15 miles east from the west point of Bòina Bay. This bay is $3\frac{1}{2}$ miles across the entrance to Andrombatò, within which is Mojangà spit in $15^{\circ} 42' 54''$ lat., and $46^{\circ} 20'$ long. ($46^{\circ} 18' 34''$, Grandidier). Inside the bay extends 17 miles from the entrance to the mouth of the river Bètсібòka, and measures nearly 8 miles across. About 6 miles in, the shores approach opposite a projection, Piripiriny Point, on which is the village of Nòsimbanàna and the ruins of the old town of Bèmbatòka. The western side of the bay is low near the sea, with hills rising inland, and skirted by reefs for $1\frac{1}{2}$ miles. The eastern side, between the two points, forms a hollow but shallow bay. In the centre is a deep and clear channel, trending about south-south-west (true), by which the anchorage south of the town is reached where a ship lies safe in from 4 to 8 fathoms.

fore it has been well fortified and garrisoned." He adds:—"We must destroy Màrovoà as well as Fàrafàtra, but my stay there will be fatal to our men. The point to occupy will be Mèvatanàna, situated on an elevated plateau, perfectly healthy, on the other bank and almost opposite.

"At Màrovoà as at Fàrafàtra the Hóvas were and are still commanded by Europeans; their number is very considerable, and we have given them all this time to make preparations for fighting us with a discipline of which they were incapable last year."

On the 3rd July, a grand review was held on Mâhamàsina, the great parade ground at the capital, where from 20,000 to 30,000 regular troops, dressed in white tunics, dark blue cotton trousers, with brown helmets, and armed with breech-loading rifles, were drawn up and inspected by Rainilaiàrivòny. The Queen rode down the line and great enthusiasm was displayed.

8th August.—On the 8th August Ambòdimadiro in Ampàsindàva Bay was occupied by the French, who landed from the "Chacal" and "Pique," gunboats, and a site chosen where a redoubt for a garrison of fifty-five men was thrown up. The Sàkalàva in the neighbourhood were friendly.

22nd August.¹—On the 22nd August, Mâhanòro was bombarded by

"Mojangà town is situate on the south side of a spit and is divided as usual on this coast into two portions. The upper is on a ridge surmounted by the palisaded fort and the residence of the Hóva governor. The lower town, joined to the former by a straight road, extends half a mile along the shore, with many houses of Indian construction of stone, sun-dried bricks, and cement, inhabited by Banians, British Indians, and Arab merchants. There are two mosques, one Arab and the other Indian. The Sàkalàva huts are of slight build and are frequently burnt. Their number has been estimated at 1,600, and the population, including the Hóva garrison, may probably number 12,000. Formerly Mojangà was an important place, containing a large population of Arabs and others principally engaged in the slave-trade. Later the British Steam Navigation Company made Mojangà a port of call, but this communication has been broken off. At present the steamers of the Messageries Maritimes maintain regular communication between Mayotta and Mojangà. It is high water, full and change at 4h. 30m.; springs rise 16 feet. The tidal streams run strongly.

"The head of Bèmbatòka Bay expands into a wide basin into which the river Bètsibòka flows. The tidal portion of this river extends 50 miles from the head of the Bay. In June 1876 the boats of H.M.S.S. 'Thetis' and 'Flying Fish' ascended the Bètsibòka for 100 miles. When beyond the influence of the tide a steady current of about two knots per hour was encountered."

¹ Mahambo was declared blockaded from the 10th August, and Foule Point on 5th October.

Vàtomàndry, after the blockade was established by Admirals Galiber and Miot, gradually became of some importance as the port which remained open latest after the bombardment of Mâhanòro in August 1884. Mâhanòro, like Vatomàndry, has only been used as a port by foreigners since Tamatave was occupied by the French, and both these places latterly have increased in size. The official residence of the Hóva governor is at Bètsizaraina, about 6 miles inland up the river Sàsaka. Should a railway be constructed from the capital and follow, as proposed, the line of the Mangòro, Mâhanòro, which is 7 miles north of the mouth of the great river, will occupy a favourable position for a large depôt. 70 miles south of the Mangòro is Tànandàva, a Hóva fort within the southern limit of the province.

The inhabitants about Vatomàndry belong to the Antèva clan of the Bètsimisaraka tribe. South of the river Manàndry, in 19° 40' lat., the Antatsimo, a branch of the same tribe.

the "Allier." This was a place of some importance, since the occupation of Tamatave, forming a part of direct communication with the capital.

September.—The small garrison at Ambòdimadiro was repeatedly harassed by night *alerte*, and consequently it was increased to 100 men under Captain Pennequin.

October.—This Officer having ascertained the existence of a Hóva camp at Anjaibòry near Anòrontsànga, surprised it on the 18th October. On that date the Hóva camp was reached after a march of seven hours and attacked with complete success; out of the 400 men composing the garrison, the Hóva Commander was killed with fifteen of his men and some eighty were wounded, the survivors retiring to Ankàramy, about 30 miles from the coast.

The French had only one man wounded.

About 100 rifles and a quantity of ammunition were captured. On the 30th October, Captain Pennequin made a reconnaissance towards Ankàramy and another on the 14th November, but no signs of the enemy were met with.

The Hóvas were now closing round Mojangà in considerable force, so that the French were compelled to make constant patrols to clear their front. Nevertheless strong batteries were erected on the right bank of the river, and all tributaries leading into it were stockaded.¹

November.—Admiral Miot when reporting the above reconnaissance stated that the movements of the enemy were notable for the unusual regularity of their manœuvring, which was evidently directed by Europeans. The Admiral said it would require at least 2,000 regular troops to clear the vicinity of Mojangà at this date.

Towards the end of the year operations of considerable importance were carried out in the north of the island. Admiral Miot, who had visited the coast in September, was of opinion that with the resources at his disposal and the assistance he might expect from the Sàkalàva, the occupation of the northern districts should be attempted. As a preliminary measure the "Beautemps-Beaupré," the "Allier," and the "Scorff" conveyed a force to Diego-Suarez Bay,² and to Vòhimàro, both of which points were occupied without opposition.

¹ Colonel Shervinton's MS. account.

² The entrance to Diego-Suarez Bay, otherwise British Sound (native name Antòmboka), is in 12° 14' S. lat., 49° 24' E. long., and is about 1,200 yards in width. It has above 30 fathoms depth close to its south side, 24 fathoms in mid-channel, the water shoaling to the north to four and three fathoms near Clarence Island (Nòsy-Vòlana), which joins the main at low water. Three miles within the entrance is a conspicuous rock, and just within the inner south head is a small cove with a sandy beach (Espègle Cove), with good anchorage out of the tideway, which runs with force through the entrance. Within the sound runs up 8 or 10 miles into various arms, with from 20 to 5 fathoms nearly to their heads. Of these on the north the easternmost is Irish Bay or Baie du Tonnerre (native name Dòvotsa-vàratsa), opposite the entrance of which is Nòsy-Langòro or Ile de l'Aigrette, which commands the channel. West of this is English Bay or Baie des Cailloux Blancs (Dòvotsivàtofòtsy), divided from the former by Cape George. This last inlet is only separated from the west coast by the narrow neck of land before alluded to two and a half miles across. On the south side are yet more extensive inlets, viz., Scotch Bay or Baie des Français (Dòvobazàha), Welsh Pool, Port de la Nièvre,

A point in one of the spacious inlets of Diego-Suarez Bay was occupied by a detachment under Captain Caillet, and the "Creuse" anchored in the bay.

27th November.—The Fort of Ambòaniho, some 14 miles south of Vòhimàro, was occupied without resistance by a company of marine fusiliers, a company of marine infantry, and the sailors of the "Beautemps-Beaupré" and "Allier." The French force was here joined by 1,700 Ankàrana, who had marched across the island from the north-west coast, and it was resolved to attack the Hóva stronghold of Majàkatòmpo, an entrenched cantonment on the plateau of Àndrapàrany, 22 miles west of Ambòaniho, and this operation was successfully accomplished by Captain Escande.

5th December.—From Captain Brun's report it appears that Captain Escande left 27 men and 75 Ankàrana in garrison at Ambòaniho, and left that station at 1 A.M. on the 5th December, with the following force:—

| | |
|--|-----|
| 5th Company Marine Fusiliers | 121 |
| 21st Company Marine Infantry | 90 |
| Landing company, "Beautemps-Beaupré" .. | 52 |
| Artillery detachment (1-65-mm. gun) | 7 |
| Gendarmerie mounted..... | 11 |

Total..... 281

Native auxiliaries, Ankàrana, (flint guns
and spears) 1,200

The plateau of Àndrapàrany forms a strong position of 650 feet

leading into the Cul-de-sac Gallois; whilst the westernmost bay under the hill called Dover Castle is Sepulchre Bay. A height named Windsor Castle appears to dominate over the hills on the isthmus, and thoroughly commands the land approach to the peninsula of Bòbaòmby. High water full and changes at four hours. Tides rise $9\frac{1}{2}$ feet. The scenery round is beautiful, and the country reputed healthy in comparison with the other coasts of the island, but it is thinly inhabited. The Hóva port is at Antòmboka, $12^{\circ} 16' 40''$ lat., $49^{\circ} 17' 49''$ long., and the Government fort at Ambòhimàrina, $12^{\circ} 24'$ lat., $49^{\circ} 24' 14''$ long., two hours' journey inland from Antòmboka.

About 27 miles to the south is the principal trading port to the north of Madagascar. Vòhimàro Bay is a fine sheet of water, shut in by a coral reef, with a narrow entrance from the south-east, safe for the largest ships with a fair wind. On the south side is the trading town Vòhimàrina, Ihàrana or Hiàrambazàha, in $13^{\circ} 23'$ S. lat., $50^{\circ} 0' 49''$ long. The anchorage is good, but during strong south-east winds the sea breaks across the entrance. Vòhimàro is a place for export of cattle, and contains about two hundred houses, many of which, however, are now empty. When ships arrive in the port for bullocks the Antankàrana flock in, with Hóvas from Ambòaniho, and the town is crowded until the departure of the vessels. Vòhimàro was bombarded in October, 1884, and on the 21st November, taken possession of and occupied by the French.

Ambòaniho, the Hóva town and fort, is 8 miles south of Vòhimàro, and about 1 mile from the sea-coast in $13^{\circ} 29'$ lat., $49^{\circ} 58' 14''$ long., and situated on a slight eminence commanding an extensive valley, watered by two streams. The citadel consists of an enclosure palisaded in the usual manner, covering an acre of ground; within are the houses of the Governor, Staff, soldiers' huts, magazine, &c. A few guns are mounted at the entrances and corners of the ròva. The Hóva and native villages outside contain about a thousand inhabitants.

elevation, commanding the valley of the Fanàmba, protected on the east by a chain of wooded mountains, and on the north and west by steep slopes, intersected by ravines and obstructed by belts of wood, advantageous for ambuscades. A reconnaissance showed that the gun could not cross the stream without being dismounted, and after this was passed, a wild gorge had to be ascended at a slope of nearly 45° .

The Hóvas, who had sought to dispute the passage of the stream, were driven back and the ascent was commenced under the fire of the enemy's skirmishers.

By 2.50 P.M., while the gun and ammunition were being got over the stream, the infantry continued to advance, impeded by abattis, but the dead body of a Hóva and the wounded carried away by their comrades showed the effect of the French fire.

The 5th Company Marine Fusiliers first reached the crest of the ridge, followed by the sailors of the "Beautemps-Beaupré," while the marine infantry continued along the bottom of the ravine.

All the movements were methodically carried out by successive rushes and no casualties yet occurred.

Meanwhile the native contingent was ordered to make a détour by the west and effect a diversion on the enemy's flank.

By 4 P.M. the plateau was gained and its full extent ascertained. From north to south it stretches 3 miles with a depth from east to west of about 500 yards, being covered with pasturage sprinkled with patches of wood. The Hóva cantonment surrounded by a simple fence lay at the north-west end, and in its centre was the róva, or citadel, a stockaded redoubt. It was of rectangular form, 75 yards by 55 yards, with palisades formed of timbers 13 feet high, and from 6 inches to 8 inches thick, but not loopholed for musketry; four *tambours*, each armed with one gun, placed in the centre of each face of the stockade, afforded a flank defence; these "*tambours*" were provided with platforms for musketry fire, laid 8 feet above the gun *emplacements*. The Hóva cantonment was farther protected on the north and east by a deep, narrow ravine, constituting a natural ditch, all the more formidable from being imperceptible until close upon it.

In this ditch and on the edge, forming a kind of counterscarp, the enemy had posted his best troops, and two guns had been placed in position at either end.

At 4.30 P.M., after a short rest, the naval and military commanders having jointly decided on the plan of attack, the companies were reformed in attack formation, and the signal to advance was given.

The chain of skirmishers gained ground quickly, driving the enemy before it, and the enemy took up his position in the ravine, directing salvos of case from the four guns against the French.

The action was now general along the whole of the plateau on a front of about 3,300 yards, when the 65-mm. gun came into action at about 1,100 yards from the Hóva stockade and maintained a continuous fire.

On reaching to within 160 yards of the ravine the first line of

skirmishers under Lieutenant Bertand was moved to the right so as to turn the ravine, and enfilade the defenders, whose fire was beginning to tell; and three of the French here fell wounded, one mortally.

Captain Bergeolle's company of the marine infantry followed Bertand's, and the sailors were soon afterwards ordered to take the same direction; the gun was left in position with a weak escort of the gendarmerie, who were now dismounted and maintained an effective fire.

At 5 P.M. the movement on the right became developed and the line of skirmishers was deployed at right angles to the ravine, which they enfiladed with a heavy fire. The Hóvas now sought to climb the slope of the ravine with a view to regaining the stockade, but the greater number fell.

The decisive moment was at hand; the intervening interval of 50 yards was covered with a rush, and those Hóvas who still remained threw down their arms and endeavoured to escape along the high grass at the bottom of the ravine. None attempted to surrender and the ravine was strewn with their dead bodies.

The victory was complete. All the Hóva chiefs with their best men were killed; while the remainder, a disorganized mob, fled towards the west, as the southern road was guarded by Martel's detachment.

The Ankàrana who had hitherto kept at a distance now hurled themselves on the village and camp with yells and were with difficulty prevented from slaughtering the wounded. The 65-mm. gun now came up dragged by the gunners and Ankàrana auxiliaries, and with a few well-directed rounds completed the rout of the fugitives.

The fighting was over at 5.30, having lasted three hours. At 6.30 the left column, which had inflicted great loss on the fugitives, entered the village. The enemy may be said to have been almost annihilated; the plateau of Andrapàrany and the streets of the village of Manjàkatòmpo were strewn with over 800 dead bodies, including those of Raínimàrosabànina, 12vtra, who commanded, and his sons.

The Sàkalàva Chief Rafojà, a faithful ally of the Hóvas, was also killed. A large amount of booty, flocks of cattle, and five guns were captured.

After this successful engagement, Commandant Escande returned to Vòhimàro, leaving Ambòaniho occupied by a French detachment and 200 Ankàrana.

Wooden huts were erected at Vòhimàro and Ambòaniho for the European troops, but there was a considerable amount of malarious fever. These operations in the north of the island were regarded by the French Admiral as of considerable importance, resulting in the overthrow of the Hóva power in the province of Vòhimàrina.

Admiral Miot, writing on the 20th December, states:—

20th December.—"It results from this expedition that we are absolutely masters of the northern part of Madagascar, which extends from Cape Amber (lat. 12°) to the 14th degree S. latitude. The forces of the Hóvas in this district are annihilated; the fugitives wander without leaders, without clothes or provisions.

In short, the results of this day surpass all our hopes. The destruction of the Hóvas is complete in this province, and here for a long time we have nothing to fear. The military operations are consequently finished, and we proceed to occupy ourselves solely with the establishments.¹

"Have no anxiety about Fàràfàtra. All the fuss about it is inspired by personal interests, and at least it will be always easy to go there with the object of slaughtering the Hóvas, otherwise we shall gain there no advantages nor any military or political result.

"If the operations against Màrovoà and Mèvatanàna can be executed from August to October with a sufficient number of troops I believe that the Government of Imèrina will accept all our conditions. I estimate that to accomplish this it will need about 3,000 men; but have no illusion, the Hóvas will not make peace until they have been beaten wherever we meet them, and it is not with a thousand men, whose ranks are daily thinned by the fatigues of the campaign, that we shall obtain an important result. The distances and the transport are serious elements with which the severe climate must be taken into consideration."

Notwithstanding the success of the late operations no further attempts were made by the French to advance into the interior.

15th February.—On the 15th February, 1885, reinforcements for the volunteer battalion from Réunion reached Madagascar, raising their effective to four weak companies, and some gendarmes arrived at Tamatave, from which small detachments were sent to strengthen the detached posts at Diego-Suarez and Vòhimàro.

On the 24th and 25th February a violent cyclone visited Tamatave, causing serious damage to the shipping.

During this period the health of the troops was reported fairly good, there being 5 per cent. sick afloat and from 10 to 12 per cent. on shore.

At this period Captain Pennequin visited the chiefs Mònja and Bènaò, in the neighbourhood of Bàvatòby, Ankify, and Sàmbiràno; and with their assistance succeeded in raising a company of 100 Sàkalàva, which was put in training under European supervision.

Captain Pennequin also visited Anòrontsànga, and reconnoitred the river Bèràndra and the road towards Ankàrana.

The occupation of Anòrontsànga was projected by Admiral Miot, but not effected, but Captain Pennequin ascended the valley of the

¹ Later the Admiral adds:—"From interrogation of a wounded Hóva Officer it appears that not more than 100 Hóva soldiers and 200 women and children escaped. Àndrapàrany was their last refuge in the province of Vòhimàrina, and the fugitives were forced to flee into the forests without food, clothing, or ammunition. At Sambàva there are but thirty or forty soldiers, who must abandon the place when we show ourselves. At Ngòntsy (Cape East) there are only 100 men, who will do the same as those at Sambava. At Maròntsètra (Antongil Bay) the last year's garrison has not been reinforced. In the north, near Diego-Suarez, I am assured that the Hóvas are badly supplied with arms. We are therefore absolutely masters of all this part of Madagascar, and if by next April you can send me 2,000 men I guarantee to drive them from Màrovoà. . . . Time alone will correct the defects in the manners and barbarism of the Tankàrana; but nevertheless I consider it a great result that a column of 1,700 Tankàrana should have crossed the country, and that I have received a visit from Tsiàlàna here at Tamatave, who comes to pay homage to France. The Hóvas have disappeared, the Tankàrana have retaken the route from the west, and the Sàkalàva will reoccupy by degrees their villages under the protection of our flag."

Sàmbiràno some 40 miles from the coast, and found the native population quiet with no trace of Hóvas.

The Hóvas, after the destruction of Manjàkatòmpo, concentrated at a point between Màndritsàra and Ambàtondrazàka, north of Lake Alaotra.

General Willoughby formed a large camp of instruction near Ilàfy, about 3 miles north of Antanànarivo, comprising some 20,000 men.

March.—According to the estimate furnished by the Minister of Marine in March the force provided for the Madagascar expedition at this time consisted of—

Naval Force.—5 ships of the regular division of the Indian Ocean station, with 900 men; 13 other ships, including 7 transports with a battalion of marine fusiliers and 100 native sailors—2,250 men.

Military Force.—Marine infantry and artillery, 1,415 men; the volunteer battalion of Réunion, 625 men, and a disciplinary company of 240 men from the disciplinary dépôt at Oléron, making a total of 2,280 men.

The joint naval and military forces would thus furnish 4,530 men.

The expenses of the expedition are stated to have been at the rate of 40,000*l.* per month.

The disciplinary company and a draft of 300 marine infantry reached Madagascar at the end of April.

14th March.—Admiral Miot wrote on the 14th March ¹:—

“The Hóvas are collecting in strength, and fortify themselves near Mojangà. They have built a regular fort and constructed a strongly entrenched camp on the right bank above the river. There is no longer any doubt as to their leadership. It is certainly European Officers who advise them.”

The following is the estimate of the distribution and force of the Hóvas outside Mojangà forwarded by the Admiral:—

“It is impossible,” writes Admiral Miot, “that the actual state of affairs which we keep up at Madagascar must not entail from year to year far larger development in our means of action. It is sufficient to recall the military situation which the Hóvas occupied in June, 1883, as compared with that which they occupy to-day. Should the year 1885 close without our having undertaken anything beyond what we now do it will be lamentable. The Hóvas organize themselves, drill and fortify themselves; they realize and maintain more than ever, in the eyes of the tribes over whom they rule, the fact of their dominant superiority, and show them that if they are not invincible they are at least unconquered. In ousting them from Fàrafàtra, Màrovoà, and Ankàramy, I am persuaded that we need not march upon Antanànarivo. The people, wearied out with the war, would impose peace on the Prime Minister. What is needed for this operation? 3,000 men more or less. In 1884, they have seen Vòhimàro, Diego-Suarez, and Ampàsindàva fall into our power. We cannot hesitate, and however onerous may be the duties which our honour imposes they must be accomplished by the undertaking of active measures. According to my advice, we must act towards September on the east coast and at the end of June on the west coast. The means at my disposal for this purpose are absolutely insufficient. I shall confine myself to guarding the posts already occupied; but a large proportion of the troops is weakened by the bad season, and requires reinforcements.”

| | Men. |
|---|--------|
| At Andrèkitza and outposts..... | 900 |
| At 20 minutes from Andrèkitza..... | 800 |
| At the head of the bay of Mojangà (post of observation) | 200 |
| At 20 minutes further at Betsakòana | 800 |
| At the camp of Ramàmba. Commander-in-Chief | 9,000 |
| Beyond at Ambàtolafia | 160 |
| At Mòraràmana | 125 |
| Distributed along the right bank of the river, about | 120 |
| Besides, at Màrovoà | 1,000 |
| Total, about..... | 13,105 |

Of these there are at the advanced posts before Mojangà, 2,500 (at about 8 kilometres).

I put down 2,000 as servants or slaves, there will remain a force of about 10,000 men with whom we must deal, the best soldiers of Imèrina. They have breech-loading field-pieces.

"Màrovoà," writes Colonel Shervinton, "was made impregnable to assault, and, although the French gunboats frequently bombarded it, no damage was done, the garrison being safe in their bombproof galleries. This post was situated about 20 miles from Mojangà, and three of its sides were surrounded by swamps; indeed, a landing from the river would have been accompanied with heavy loss, as the banks were composed of deep soft mud and well swept by the fire of the town, whilst the firm ground between the river and the town was one mass of rifle-pits. A small tributary almost encircled the hill, forming a natural fosse, and the sides of the hill were scarped to a height of 35 feet from its crest."—(*MS. account.*)

March.—The health of the French soldiers was reported as very bad in March, the sick rate at Tamatave being as high as 50 per cent. The sick were collected from the different parts of the island and conveyed to Réunion for transhipment to France.

April.—Early in April a small detachment of forty men from the "Creuse," lying in Diego-Suarez Bay, proceeded inland some distance on a foraging expedition under Midshipman Crova, and was surprised by a band of Hóvas on its return. M. Crova was slightly wounded, but the party effected its retreat in safety under Dr. Ferraud.

21st May.—On the 21st May an attack on Mojangà was repulsed with a loss to the Hóvas of six men.

At the end of May 1,000 men were selected, and after being medically inspected and carefully equipped were despatched by easy marches to the north-west to commence operations against the French at Ambòdimadiro and the neighbouring Sàkalàva. This expedition left Antànànarivo on the 1st June.

June.—In June negotiations were reopened by MM. Baudais and Miot through the mediation of the Italian Consul, Sr. Maigrot, but M. Baudais's insistence on the French protectorate prevented any satisfactory conclusion being arrived at. M. Baudais's acceptance of Sr. Maigrot's mediation was unauthorized by the French Government, who disavowed the proceedings and recalled their Commissioner.

July.—A battalion of marines reached Tamatave from France at the end of July, and a mountain battery and a company of marines.

August.—Infantry from Tonkin arrived at the beginning of August. Urgent requests were sent by Admiral Miot for more reinforcements and more surgeons, for the health of the force was so bad that at Vòhimàro (supposed hitherto to be comparatively a healthy station) there were said to be 80 per cent. of sick.

August.—Towards the end of August the two gunboats, "Tirailleuse" and "Redoute," made their way up the Bètsibòka River, passing by night an entrenched camp of the Hóvas, Ramàmba, and arrived within 2 miles of Màrovoà. The Hóvas opened fire upon the gunboats with rifled guns, to which the boats replied with their 10-cm. guns, and afterwards with their Hotchkiss guns, and succeeded in silencing the enemy's fire, and dispersing the defenders with some loss.

The Hóva expedition which left the capital for the north-west under Andriantsilàvo's (nominal) command (Colonel Shervinton, who accompanied the force, in reality directed the operations), was moved towards Ampàsindàva Bay, arriving at Ankàramy on the 14th August.¹ As the Sàkalàva Chief of Jangòà was in alliance with the French, it was resolved to chastise him, and on arriving within 50 miles of that place, a road was cut through the forest a distance of some 40 miles, a task which occupied three days and a half. At midnight on the 26th August, the column debouched from the woods on a plain within 8 miles of Jangòà, and before daylight it was surrounded, sacked, and burnt. Bush fighting continued all the morning, but the inhabitants mostly escaped by the river, and but few were killed and few prisoners taken.

HÓVA VERSION.

Battle of Andàmpy or Bèfitina.—The French at Ambòdimadiro, hearing of the capture of Jangòà, came out prepared to attack the Hóva force, which had been strengthened by 400 men from the Ankàramy division. Including bearers and camp followers there were about 3,000 in all of the Malagasy.

The latter also pushed northwards in the direction of Ambòdimadiro, and three days after the capture of Jangòà the armies met at a place called Bèfitina.

The French had 250 of their own troops who were seen coming over some

FRENCH VERSION.

On the morning of the 26th August a stampede of Sàkalàva reported the enemy to have invaded the valley of the Jangòà, where they were massacring the natives and firing the villages.

Captain Pennequin at once made arrangements to attack, and at noon the native company (70 men) took the direction of Jangòà, followed two hours later by a French detachment of 50 men; 40 men being left behind in charge of the fort at Ambòdimadiro.

Jangòà was found in flames, and the Hóvas had crossed into the Sàmbiràno valley, but it was ascertained from the Sàkalàva that the enemy were in position at a place named Andàmpy, about 2 miles from Jangòà, and Captain Penne-

¹ "The force had marched slowly, as the object was to bring the men up in good health and spirits and run no risk of fever. Owing to the care taken of the men the expedition only lost three of its number from fever during the four months it was away from Imèrina."—(MS. account.)

HÓVA VERSION.

rising ground early in the morning of the 27th August.

They had their machine-guns, and the Hóvas were furnished with two Hotchkiss guns.

At a distance of about 650 yards the two bodies halted and commenced firing. Almost at the first discharge of the Hotchkiss guns the French sergeant was shot, his head being nearly severed from his body.

The French kept up rapid firing, but their machine-guns were very badly managed.

While this was going on, an army of Sàkalàva appeared on the Hóva right wing, armed with double-barrel shot guns and old arms supplied by the French. The Hóvas, although surprised, had little difficulty in putting these Sàkalàva to flight.

Then would have been the time for the French to have advanced, it might have inspired vigour into their Sàkalàva allies, but they stood looking on whilst the Hóvas inflicted a defeat on them.

Meantime a number of Hóvas worked round the right flank of the French, and seeing that the French had missed their only chance of success, they fired two volleys, and 200 of them with cheers rushed on to the hesitating French. The Hóvas were quite down upon them before the French were aware of it, and after a desultory and very short feint at resistance, they broke ranks and fled promiscuously.

A French Officer stood to his guns, and directed them persistently on any attempt to capture them.

The Hóvas then pursued the flying enemy for several miles down to the river side and cut them down.

FRENCH VERSION.

quin decided to move forward on the 27th, and at 8 A.M. gained contact with the Hóvas.

The Hóva position was admirably chosen on the scarped sides of the Andampy hill flanking the Sàmbirano valley. Placing himself between the enemy and the river, intending if necessary to withdraw down stream, where the population was friendly, and supplies had been already directed by sea, Captain Pennequin opened the fight by a few volleys, which were answered by two guns and a well-sustained musketry fire. The extent of the Hóva position was soon ascertained; it covered about 1,100 yards of front, and was occupied in a methodical form by skirmishers, supports, and reserves, the guns being posted under escort on the extreme right.

The Hóvas swept the ground with a hail of bullets, but the French being dispersed behind thick cover afforded by fallen trees in a burnt wood suffered little. The enemy's fire was gradually subdued, and a small party creeping up to within 900 yards of the guns succeeded in silencing them, and they were withdrawn.

The strength of the Hóva position separated it from the French column by an intervening steep ravine, which made it unassailable in front and on the right flank; on the left, however, the ground was more favourable, and Captain Pennequin withdrew his men gradually towards this flank.

While this movement was being carried out under cover of an intermittent fire, the Hóvas, probably under the impression that the French were retiring, rushed down with loud shouts from their position.

Captain Pennequin formed his men into square on a mound overlooking a dip in the ground, and just within the border of a wood, which enabled him to watch the enemy, while his own movements were concealed.

Hidden away in thick brushwood they silently awaited the onslaught of the Hóvas with fixed bayonets.

The foremost bands were met with a volley at ten to twenty paces from the front face, and subsequent attacks on

HÓVA VERSION.

It was estimated that more than 100 out of the 250 were missing, and the next morning the bay was covered with boats picking up the fugitives.

The Hóva loss was eight killed and fourteen wounded. The French were said to have lost 100 in killed and wounded. The result was that Mònja, the Sàkalàva king, sent in his submission to the Queen of Madagascar.

September.—Just a fortnight after the French disaster at Andàmpy Admiral Miot decided to make a vigorous attack on the Hóva lines outside Tamatave; but the projected attack was too openly discussed previously, and it is said that the Hóvas, who numbered over 21,000 men, were fully aware of the date fixed for the intended assault.

September 10th, Battle of Sàhamàfy.

On the morning of September 10th, at 6.30 A.M., the French heavy guns on the fort at Tamatave and on the ships in the harbour opened fire on the Hóva lines, so as to cover the advance of their troops. This firing continued without intermission for two hours, and nearly 700 shells were sent into the camp, which were counted at headquarters.

At about 8 A.M., 2,000 of the French troops threatened to make a front attack, but then wheeled towards the south opposite one of the Hóva works at

FRENCH VERSION.

the flank faces were similarly repelled with great slaughter. A final effort by a general rush from all points at once, drums beating, &c., met with no greater success, and the enemy fled in all directions, followed up by the French fire.

Immediately around the square were found forty-eight bodies.

The French loss was one sergeant killed and fourteen (of all ranks) wounded. Of these the sergeant was killed and fourteen wounded in the earlier phase of the fight. A general pursuit was not possible. The fight had lasted three to eight hours, and besides being exhausted and deficient in ammunition, the French column was numerically too weak.

The French force at Tamatave was formed in two columns of unequal size. The main division, 1,300 men, under Lieutenant-Colonel Romouil, Marine Infantry, was composed of Marine Infantry, Réunion Volunteers, Marine Fusiliers, Marine Artillery, and a train of Malagasy coolies under European direction.

The second division consisted of landing parties from the "Naïade" and "Nielly," under Captain Lecuve, in all 200 men.¹

Admiral Miot's plan was to seize Sàhamàfy, when little resistance was anticipated, to secure the bridge of boats near this village, find a ford known to exist, cross the Sangàlatra, carry the village on the Hóva right rear, and from that point take the camp in reverse.

The troops were in excellent spirits. The principal column advanced slowly at 4.45 A.M., preceded by fifteen gendarmes mounted, taking a south-westerly direction towards Sàhamàfy; whilst the smaller column made a diversion towards the north.

The first column was followed by a battery of artillery, and a small bridge-train, with a long string of mules with food and ammunition.

¹ The "Naïade," "Nielly," "Bisson," and "Correze," were in the harbour, and covered the advance with their fire.

HÓVA VERSION.

Sàhamàfy, which was made the object of the principal attack.

At the same time 200 men were despatched to attack the Hóva posts to the north, with the object of preventing the Hóvas from concentrating their forces. Fighting lasted till 3 P.M., when the French retired with a heavy loss of killed and wounded.

The Hóvas behaved very well, cheering and dashing into close quarters with the French.

The return march to Tamatave was almost a rout; the troops straggling in anyhow, quite exhausted and many of them without arms.

A column had been told off to harass them, but owing to the negligence or culpability of the Officer commanding it, nothing was effected.

The Hóva army consisted of about 7,000 men and 15 guns. There were 1,000 men holding Sàhamàfy.

A French flag fell into the hands of the Hóvas.

A few days afterwards General Wilmoughby made a night attack on Tamatave, with the object of making the French believe that he had plenty of ammunition; whereas had the French renewed their attack the Hóva ammunition would have run short.

FRENCH VERSION.

At 9 A.M. the first contact with the enemy was gained. The scouts pressed on, but in front and on the right the enemy opened a steady, well-directed infantry fire, supported by a few rounds from field-guns. It became necessary to halt and close up. At the end of the path, at about 750 yards distance, appeared the palisades and huts of Sàhamàfy; to the right and on the other side of the Sangalatra, at 550 yards, was a palisaded redoubt, the existence of which had not been suspected previously.

About 9.30 A.M. the scouts dismounted and commenced firing till the advanced guard came up. The ground towards Sàhamàfy was covered with thick brushwood, but had been cleared near the redoubt. The existence of a stream in front of the latter was inferred from the high grass gleaming in the sun. The ford was probably there.

The infantry came up and opened a heavy fire on the work, which replied vigorously, and the French soon had nineteen men *hors de combat*. The battery of artillery was now advanced, and came into action at 550 yards range from the work, the enemy replying with a volley to each shot.

The artillery sustained severe losses; a sergeant-major was killed, a Lieutenant and Captain were wounded, the former mortally. The gunners behaved with admirable bravery, and continued to work their guns under a galling fire.

Admiral Miot now determined to fall back, and the retreat was carried out in good order, and but slightly harassed by the enemy. The second column had successfully accomplished its task, having met with but few of the enemy, and driven them across the Rànomainty without any casualties.

The French loss was 2 men killed, and 32 wounded, including 5 Officers; 3 of the wounded, including 1 Officer, subsequently died of their wounds.

Sàhamàfy.—The attack resulted, unquestionably, in a complete repulse for the French. Admiral Miot was said to have shown great personal bravery, but his dispositions for the attack were severely criticized, especially the bringing a battery into action at so short a range from the enemy's works.

Distribution of the French Force in September.—At this time the

distribution of the French troops in Madagascar appears to have been as follows :—

| | | |
|--------------------------|---|--|
| | { | Marine infantry, 2½ companies, |
| | { | Marine fusiliers, 1½ " |
| <i>Mojangà</i> | { | Disciplinary company, ½ company, |
| | { | Réunion volunteers, 1 company, |
| | { | Ankàrana auxiliaries, 1 company. |
| <i>Ambòdimadiro</i> ... | { | Marine infantry, 1 company, |
| | { | Sàkalava contingent, 1 company. |
| <i>Nòsy-Bé</i> | { | Disciplinary company, ½ company. |
| <i>Diego-Suarez</i> | { | Marine infantry, ½ company. |
| <i>Vòhimàro and Am-</i> | { | Marine infantry, 1 company, |
| <i>bòanlho</i> | { | Réunion volunteers, 1 company, |
| | { | Ankàrana auxiliaries, 1 company. |
| <i>St. Marie</i> | { | Disciplinary company, ½ company. |
| | { | Marine infantry, 6 companies, |
| | { | Marine fusiliers, headquarters battalion, ¹ |
| <i>Tamatave</i> | { | Marine artillery, 2 batteries, |
| | { | Réunion volunteers, 2 companies, |
| | { | Gendarmerie, detachment. |

M. Baudais, the French Commissioner, having been recalled, M. Patrimonio, the French Consul-General at Beyrout, was associated with Admiral Miot as Plenipotentiary, and after some preliminary *pourparlers*, peace was finally concluded, and a Treaty signed on board the "*Naïade*" on the 17th December, and ratified on board the flagship by General Digby Willoughby on the 10th January, 1886, and by the French on March 17th, 1886. The word *Protectorate* was expressly kept out of the Treaty.

The clause of the Treaty which most affects British naval and military interests in the Indian Ocean is Art. XV.

"Nevertheless, the Government of the Republic reserves to itself the right to occupy the Bay of Diego-Suarez, and there to form establishments at its convenience."²

The zone round the bay thus *reserved* by (not *ceded* to) the French is limited so as not to extend beyond 1½ miles (geographical) south, west, and east, and 4 miles north, reckoning from the deepest inlet of the bay.

It will be seen from the accompanying map that, although it is stated that the Hóvas must necessarily abandon the remaining moiety of the peninsula of Bòbaòmby, as far as Cape Amber, the Hóvas can still by right maintain a passage along the Windsor Castle isthmus to the valuable ports of Robinson, Jenkinson, and Liverpool.

The battalion of Réunion volunteers sailed for St. Denis on the 17th January, and was at once disbanded.

¹ The battalion of marine fusiliers was now ordered home. It had suffered severely during its two and a half years' service in Tonkin and Madagascar, and was reduced to a skeleton. Leaving Tamatave in the "*Orne*" on September 24th, it is reported to have disembarked at Toulon only 113 strong out of its original effective of 600. The "*Orne*" had brought out a draft for the disciplinary company.

² "Toutefois le Gouvernement de la République se réserve le droit d'occuper la baie de Diégo-Suarez et d'y faire des installations à sa convenance." (Documents Diplomatiques, Affaires de Madagascar, 1884-86, p. 177.)

The French force to be retained in Madagascar for the present, until the indemnity shall have been paid, is fixed at 6 companies of marine infantry, each of 3 Officers and 100 men, which will furnish the Resident's escort at Antanànarivo, the garrison of Diego-Suarez Bay, and the garrison of Tamatave. The squadron and the remainder of the force recently employed has been broken up, the position at Mojangà evacuated, and the Réunion garrison left at 4 companies of marine infantry, of the same strength as those in Madagascar, with which they will be interchanged for relief.

The result of the war has been that the consolidated Hóva power has become a recognized factor in the military conditions which affect the shores of the Indian Ocean.¹

ROUTES.

ROUTE NO. 1.—(a.) TAMATAVE AND ANTANÀNARIVO.

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|--|---------------------|--------|--|
| | Inter-mediate. | Total. | |
| BÊTSIMISÀRAKA. <i>Tamatave</i> , 18° 10' 6'' S. lat., 49° 28' 30'' E. long. | .. | .. | <i>First day's march, Tamatave to Trànômàro.</i> From Tamatave the line of the east coast is followed southward. The coast-line is very straight, and, as a rule, for 3½ miles inland, it consists of a bed of sand, thrown up by the rough surf produced by the prevailing south-east winds; hence the absence of harbours and the dangerous open roadsteads which prevent easy communication by sea along the coast. This long line of sand-bank has formed bars across the numerous mouths of the rivers which drain the eastern watershed some 60 miles inland, and this has caused the formation of a series of coast-lakes or lagoons extending about 400 miles in length, and here and there communicating with the sea. Thus a line of inland water communication is formed along which boats can travel, the intervals over which they must pass by land being few and unimportant. The track generally taken is along these sandbanks between the sea and the lagoon. |
| Carried forward.... | .. | .. | |

¹ For further and more detailed information and maps see "Madagascar: an Historical and Descriptive Account of the Island and its Dependencies," by Captain Oliver, 2 vols., each 560 pp. Published by Macmillan and Co., 1886.

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| | | | <i>First day's march—continued.</i> |
| | | | Leaving Tamatave, the track leads over a sandy plain presenting occasionally long lines of sandbanks running parallel with the ocean, and passing through patches of wood, of <i>Casuarina</i> , various palms, and <i>Pandanus</i> . Afterwards the country is more wooded, until in two hours Anjòlokafa is reached, a straggling village on the banks of the Ivôndrona, 9 miles from Tamatave, on a tongue of land between the sea and river. A long halt is here necessary for embarkation in canoes made out of a single tree (generally <i>Inophyllum</i>), some very large, with bottoms as round as a barrel. They are from 30 to 40 feet long, and 4 feet in breadth and depth. After a short journey by water a landing is effected on the east side of Lake Nòsy-Vé, and the journey is continued from Kanomany past Ambòdinsiny (famous for the remains of an old jar of large dimensions to which superstitious veneration attaches), through clumps of trees, grassy undulations, <i>Pandanus</i> , and bushes growing in sandy soil, and remains of dead forest trees. Ground near the lake marshy; the best travelling on margin of the shore of the ocean. All this is a country permeated with miasma during the wet season. |
| TAMATAVE. | | | |
| Brought forward... | .. | .. | |
| Anjòlokafa..... | 9 | .. | |
| River Ivôndrona | .. | .. | |
| Halt. Embarkation .. | .. | .. | |
| Lake Nòsy-Vé | 2 | .. | |
| Landing. Kanomany | .. | .. | |
| Ambòdinsiny, lit., | .. | .. | |
| "at the bottom of the water-pot." | | | |
| Ambàlatambaka..... | 10 | .. | Three hours from the Ivôndrona river the small village of Ambàlatambaka is reached, but few supplies are obtainable, and it is as well to push on to Trànômàro, where rice is (or used to be) obtainable, as well as manioc for the bearers. At Trànômàro there are only two dozen houses—no supplies. |
| (Anavariana.) | | | |
| Trànômàro | 9 | .. | N.B.—The distance measured on map from Tamatave to Trànômàro (nautical survey and Dr. Mullens's map) is 27 statute miles. At about 4 miles distant out at sea along this coast are dangerous reefs, the larger named Fông Islands. |
| Day's journey | | 30 | |
| BÈTSIMISÀRAKA. | | | <i>Second day's march, Trànômàro to Vavòny.</i> |
| | | | The track still keeps southward, skirting the seashore, with rich vegetation on both sides of the lagoon, and extending to the |
| Carried forward.... | .. | 30 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| BÊTSIMISÂRAKA. | | | <i>Second day's march—continued.</i> |
| Brought forward... | .. | 30 | high-water mark of the coast-line. Pass |
| <i>Si anak angaitra</i> | .. | .. | <i>Si anak angaitra</i> , a few huts. Plenty of |
| | | | cattle are met with, herds on their way |
| | | | from the interior to the coast for embar- |
| | | | kation at Tamatave, and kraals for herd- |
| | | | ing them are frequent. |
| <i>Tànifòtsy</i> | .. | .. | Turning out of the forest at <i>Tànifòtsy</i> and |
| <i>Ampàniràno</i> | .. | .. | crossing an outlet to the sea, <i>Ampàniràno</i> |
| | | | is reached, a village on the shore of Lake |
| <i>Lake Ampàndranity</i> .. | .. | .. | <i>Ampàndranity</i> , whence the road lies be- |
| <i>Lake Alopiana</i> | .. | .. | tween another narrow lagoon, Lake <i>Alopi-</i> |
| | | | <i>ana</i> . These so-called lakes are only differ- |
| | | | ent names given to so many reaches or |
| | | | widenings of the narrow lagoon, which |
| | | | is almost continuous. At some 8 or 9 |
| | | | miles a collection of wretched cottages |
| <i>Andrànonkòditra</i> | 8 | .. | (<i>Andrànonkòditra</i>), on a high bank of |
| | | | sand, is reached. (Ellis puts <i>Andrà-</i> |
| | | | <i>onkòditra</i> at 18 miles from <i>Tranomàro</i> ?) |
| <i>Manàoka</i> | .. | .. | Opposite, across Lake <i>Iràngy</i> , is <i>Manàoka</i> , |
| <i>Lake Iràngy</i> | .. | .. | a Government station with <i>lapa</i> and flag- |
| (<i>Ampàribé</i> .) | | | staff, &c. Thick <i>Pandanus</i> groves are |
| <i>Atàkalàmpona</i> | .. | .. | traversed as far as <i>Atàkalàmpona</i> , and |
| (<i>Ambanàdrankit</i> .) | | | thick woods along the banks of Lake |
| (<i>River Andrànompàn-</i> | | | <i>Iràngy</i> , in which are plenty of lemurs, |
| <i>drana</i> .) | | | till the hamlet of <i>Pantomàizina</i> is reached. |
| (<i>Lake Antobe</i> .) | | | <i>Sago</i> palms are now noticeable. Still |
| <i>Pantomàizina</i> | 6 | .. | lagoon, marsh, wood, and sandbanks |
| <i>Lake Andràsoamàsa</i> .. | .. | .. | alternate, until, marching along the outer |
| (<i>Lake Rasòbé</i> .) | .. | .. | bank of Lakes <i>Andràsoamàsa</i> and <i>Rasòbé</i> , |
| <i>Vavòny</i> | 9 | .. | the Government port of <i>Vavòny</i> is arrived |
| | | | at on the western side of the lake. A |
| | | | black shining micaceous sand is here col- |
| | | | lected and used as blotting-paper at the |
| | | | capital (or was used so formerly). |
| Day's journey | | 23 | <i>Tranomàro</i> to <i>Vavòny</i> measured on map as |
| Total | .. | 53 | the crow flies is 15 miles. Total distance |
| | | | from Tamatave, 42 miles. |
| BETÀNIMÈNA. | | | <i>Third day's march, Vavòny to Andèvorànty.</i> |
| <i>Lake Imoàsa</i> | .. | .. | From <i>Vavòny</i> a boat voyage is practicable |
| (<i>Ambila</i> .) | | | along a reach named Lake <i>Imoàsa</i> , but it |
| | | | is usual for the bearers to take the bag- |
| | | | gage by land. There is an opening from |
| | | | the lake to the sea at 6 miles; and at |
| <i>Andàvakamènaràna</i> .. | 10 | .. | 10 miles, either by land or water, the small |
| | | | hamlet of <i>Andàvakamènaràna</i> . The na- |
| | | | ture of all the country along these lagoons |
| Carried forward... | 10 | 53 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| BETÀNIMÈNA. | | | <i>Third day's march—continued.</i> |
| Brought forward .. | 10 | 53 | is slightly diversified by wooded or partially cleared undulating soil of sand and <i>débris</i> . More lagoon, which opens out into a broad and irregular estuary, Lake Rànomainty, at the mouth of the Ihàroka river (put down in Admiralty chart as the river Jark). On the spit of sand, an elevated portion of the river bar, is the village and Government station. |
| Lake Rànomainty | .. | .. | |
| River Ihàroka or Jark | | | |
| Andèvorànty | 9 | .. | Vavòny to Andèvorànty as the crow flies is 14 miles. |
| Day's journey..... | | 19 | |
| Total | .. | 72 | <i>Andèvorànty, 18° 56' lat., 49° 9' 50" long.</i> |
| | | | <i>Fourth day's march, Andèvorànty to Rànomafàna.</i> |
| | | | The track, which has hitherto been south by west, closely following the line of the sea-coast, now turns abruptly almost at right angles away from the shore, and heads inland nearly due west in the direction of the capital. It is necessary to proceed in canoes up the river Ihàroka, which is here about 200 yards wide, with a current about 3 miles an hour. In the rainy season a large volume of water must flow down at a much greater speed. The banks are flat for the first 2 or 3 miles when they are found steeper, and after two hours' journey the roots of the first hills are reached, and the river contracts to 100 yards with a stronger stream, and becomes winding as higher levels are reached. |
| River Ihàroka | .. | .. | Several small villages are passed on the right on south bank of the river, and at 6 miles the main river is left, and the canoes turn up into a smaller stream south-west, with a current of 4 miles an hour. Hence it takes four hours to paddle up to a small village, Marònby, having passed by Ambòhibohàzo, a considerable place and a Government station. Tobacco, sugar-cane. |
| (Màrovàta.) | | | |
| (Bàtrasina.) | | | |
| (Tànimàndry.) | | | |
| (Màramandàa.) | | | |
| Junction of stream with river. | 6 | .. | Landing at Marònby, where some coffee plantations exist, the inland journey commences, and a totally different country is traversed—the change of vegetation and soil being very apparent, whilst, instead of easy marching over almost level sand |
| Marònby..... | 4 | .. | |
| Ambòhibohàzo | .. | .. | |
| Land at Marònby | .. | .. | |
| Carried forward.... | 10 | 72 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| BETÀNIMÈNA. | | | <i>Fourth day's march—continued.</i> |
| Brought forward .. | 10 | 72 | and firm turf, there is now a series of clay hills intersected by small streams with marsh and swamps between. The <i>ravinàle</i> (<i>Urania</i>), bamboo, and the <i>rofia</i> palm (<i>Sagus rofia</i>) abound. The country is desolate and little inhabited. Rice is generally cultivated in this district. The country rises gradually, till at about 150 feet elevation the village of Màmambò-nitra stands, well situated, with patches of sugar-cane, banana trees, tobacco, and rice grounds interspersed where not cultivated with <i>Erythrinus</i> (cock and hen or Cape Coral trees) and candle-nut trees (<i>Aleurites</i>). Another 6 miles through similar country, always rising, until at an elevation of 245 feet, after passing several clear streams with tropical vegetation, the hot springs and village of Rànomafàna are found. |
| Màmambònitra | 6 | .. | Distance direct of Rànomafàna from Andè- vorànty by map 11 miles. |
| Hot springs | 6 | .. | |
| Rànomafàna..... | .. | .. | |
| ("Hot water.") | | | |
| Day's journey | | 22 | |
| Total | .. | 94 | <i>Fifth day's march, Rànomafàna to Ampàsimbé.</i> |
| Ambàtoharàna..... | 5 | .. | Leaving Rànomafàna, the country traversed has many beauties, and amidst a fine amphitheatre of hills there rise several lofty cones. The streams, of which several are crossed, run deep and strong over beds of quartz pebbles. The traveller's tree grows in enormous numbers, and large patches of rich black soil appear amidst the general masses of red clay. |
| River Fàrimbôngy .. | .. | .. | The course of the track is very tortuous and follows pretty nearly the course of the Fàrimbôngy, whose waters present a succession of deep pools, cascades, and small rapids. The track ascends and descends over most slippery and steep ground, until after three hours Ambàtoeràna (595 feet elevation) is arrived at, and after similar travelling Mahèla is reached, on a stream, either the Fàrimbôngy or a smaller tributary of it; all the waters which are so often crossed and recrossed finding their way into the Ihàroka, in a broad and rapid stream. West of Ambàtoeràna, and as- |
| Carried forward.... | 5 | 94 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| BETÀNIMÈNA. | | | <i>Fifth day's march—continued.</i> |
| Brought forward... | 5 | 94 | ending a spur of the confronting ridge up to an elevation of at least 1,000 feet, a good view is obtained to the eastward back to Andèvorànty, and the site offers a favourable signalling station. Its name is Ianiankòva ("the weeping place of the Hóvas"). From hence the sea and the houses of Andèvorànty (15 miles only as the crow flies) are distinctly visible. Surmounting this hill a descent is made into the valley of the Mahèla, here 30 yards wide and 4 feet deep. Village on the left bank of the same name. Crossing this river, another lofty ridge has to be crossed, and here on the summit a Hóva guard is stationed. More up and down marching over difficult ground and a halt is made for the night at Ampàsimbé, at an elevation of 1,055 feet; the village is situated in a broad amphitheatre, the sides of the hills being densely wooded, but the larger timber has been felled. |
| <i>Ianiankova</i> | 5 | .. | Ampàsimbé is marked on Mullens's map as only 8 miles west of Rànomafàna direct. By the circuitous routes and difficult road it is double that distance. |
| Signal station..... | .. | .. | |
| <i>River Mahèla</i> | 2 | .. | <i>Sixth day's march, Ampàsimbé to Bèfòrona.</i> |
| <i>Mahèla</i> | .. | .. | |
| Station on ridge..... | .. | .. | The journey is most wearisome, continually ascending and descending over ridges and terraces, the track mostly leading along the spurs and round the shoulders of ravines between them. These numerous ridges are all higher and higher, and slope out from the mighty wall of rock which marks the upheaval of the elevated plateaux farther inland. The highest ridge crossed is 2,030 feet elevation. |
| <i>Ampàsimbé</i> | 3 | .. | |
| ("at much sand.") | | | Leaving Ampàsimbé, the path ascends and keeps chiefly along the lateral hills, and becomes more steep and rugged; the only resting-place is reached at Màrozèvo, 7 miles, a poor village with no supplies. Elevation, 1,385 feet. |
| Day's journey..... | | 15 | |
| Total..... | .. | 109 | Now follows thick forest over slippery ground with narrow passes for some miles, until a clearing and flat open valley is |
| <i>Màrozivòngy or Màrozèvo.</i> | 7 | .. | |
| Carried forward.... | 7 | 109 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| BETÀNIMÈNA. | | | |
| Brought forward... | 7 | 109 | <i>Sixth day's march—continued.</i> reached, where is situated a considerable village, Bèfòrona. But the valley is swampy and the place notorious for fever, although 1,650 feet above the sea; the mists and fogs strike chill after leaving the tropical heat of the coast level. |
| Bèfòrona | 7 | .. | |
| Day's journey | | 14 | |
| Total | .. | 123 | Ampàsimbé to Bèfòrona direct is 11 miles. The valley of Bèfòrona is 1,650 feet elevation. |
| | | | <i>Seventh day's march, Bèfòrona to Alamazaotra.</i> |
| Irìhitra | .. | .. | Beyond Bèfòrona, which may be said to mark the eastern limit of the great forest belt, we reach the foot of the great wall of rock, and, turning a little to the north (at Irìhitra), way is made over red clay hills for a slight gap or depression in the ridge, and with many a climb and as many a deep descent we at length reach a relay station and collection of wood-cutters' huts. The coast tropical vegetation has disappeared; no longer do we meet with the <i>ravinàle</i> and <i>rofia</i> , but instead, timber trees of enormous size, bamboos, and tree-ferns, interlaced with a thick jungle of undergrowth and parasites. The summit of the pass is 3,470 feet. The track here is absolutely frightful, requiring frequent detours on account of the gigantic trees which have fallen across the path. |
| Anévoka | 6 | .. | At Anévoka a level of 2920 feet is attained, and, still climbing through the worst part of the forest passes and ravines, the halt is made at the frontier Hóva station of Alamazaotra at 3,130 feet,—a rise of 1,480 feet within a dozen miles. |
| (Ambdasary.) | | | |
| Alamazaotra | 7 | .. | |
| Day's journey..... | | 13 | Bèfòrona to Alamazaotra by map is barely 11 miles. |
| Total | .. | 136 | |
| | | | <i>Eighth day's march, Alamazaotra to Mòramànga.</i> |
| Ampàsimpòtsy or Am- passapòjy | 8 | .. | The journey continues through the forest of Alamazaotra, a very trying road, full of mud-holes, and awkward streams have to be passed on rough fallen logs. At 8 miles a cleared resting-place (2,830 feet) is found in Ampàsimpòtsy; after which, still through forest, but partially cleared land, |
| Carried forward.... | 8 | 136 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| BETÀNIMÈNA. | | | <p><i>Eighth day's march—continued.</i></p> <p>a high broad ridge is crossed at 3,460 feet scored by rice-fields cut out on the sides of the valleys, and thence a descent is made to Mòramànga, a market town on the western edge of the forest belt and overlooking the plains of Ankày. Ankày proper is a long elevated plateau or terrace of sedimentary clay, 180 miles long north and south, and from 10 and 15 to 20 miles in breadth, enclosed by bordering chains of hills on either side. The level of the plain is about 3,000 feet above the sea. The chain of hills to the east has a height of 365 feet. It is rather like a tip to the plain below than an overhanging wall; it consists largely too of the same material as the plain itself, with gneiss rocks underlying and intermingled with it. The western chain, on the contrary, is a lofty wall of granite and gneiss, 1,620 feet high; it overhangs the plain in its entire length and passes far beyond it. It is the second of the great ridge walls by which so much of the contour of the island is regulated. It runs the entire length of the island, as far as known, and is covered all the way with wood, which forms the second and upper line of primeval forest. Vast buttresses of rock project into the plain from its lofty front, and deep ravines and valleys run in behind them, giving to the scenery a rich variety of outline and of detail. Ankày should be a level plain. It was once so, but its material is soft and friable, and water speedily washes it away. For countless ages storms and floods of heavy rain have made havoc of its surface. It is ploughed and scored into little valleys in all directions; but the scorings all find an outlet and pass from one to another till they reach the central drain of all, the valley of the Mangòro river. The bottom of this valley is 325 feet below the level of the plain; and the river flows in a little valley within the valley. Naturally this great draining valley with its river runs, like its enclosing walls, a course from north to south, makes its way through the eastern chain, and descends by a series</p> |
| Brought forward .. | 8 | 136 | |
| Mòramànga | 8 | .. | |
| Signal station..... | .. | .. | |
| Carried forward.... | 16 | 136 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| BETÀNIMÈNA. | | | <i>Eighth day's march—continued.</i> |
| Brought forward .. | 16 | 136 | of rapids and cascades and falls into the sea near Mánahòro. It is interesting to observe that under the western hills, where floods and water are most abundant, the plain is 100 feet lower than at its eastern side. The people who occupy this plain are Bèzànozàno or Tankàys, and are apparently a branch of the Bètsimisaraka tribes who have ascended the Mangòro from the coast; they are yet uncivilized and ignorant. They supply bearers or marmites for travellers up and down from the coast. These Bèzànozàno marmites are not tall, but strong and wiry, and are far the best bearer coolies in the island. |
| Day's journey..... | — | 16 | |
| Total | .. | 152 | |
| ANKÀY. | | | <i>Ninth day's march, Mòramànga to Angàvo.</i> |
| Andrànonkòboka | 6 | .. | From Mòramànga 6 miles' easy travelling over the grassy plain intersected with <i>nalas</i> , which form the only impediment, open country and not wooded, Andrànonkòboka, a small hamlet, is passed, and after an hour's travelling a descent is made into the valley of the Mangòro, where at a village on the left bank canoes of a very cranky description are obtainable to ferry across the river, which is here a smooth but rapid stream 30 yards wide. (Mullens puts Andàkana on the right and west bank of the Mangòro.) |
| River Mangòro | .. | .. | A little to the west of the ferry stands the lofty wooded hill of Ifòdy. This hill belongs to the western chain, but projects some miles into Ankày, leaving a long broad valley between that chain and itself. M. Dupré gives the height of Ifòdy as 3,677 feet. At the base of Mount Ifòdy is Ambòdinifòdy, where there is a Hóva guard stationed. From the summit of Ifòdy a most extensive view is obtained in all directions. |
| Andàkana | 6 | .. | The valley is now traversed, following the course of a river called by Ellis Valàla and by Mullens Màmambòla. Here there are extensive rice plantations and embankments, and several villages are passed of Hóva construction. At the extremity of the valley, which terminates in a fine |
| Mount Ifòdy | .. | .. | |
| Ambòdinifòdy | 8 | .. | |
| Signal station..... | .. | .. | |
| River Valàla or Màmambòla | .. | .. | |
| Carried forward.... | 20 | 152 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|--|---------------------|--------|--|
| | Inter-mediate. | Total. | |
| ANKAY. | | | |
| Brought forward .. | 20 | 152 | <i>Ninth day's march—continued.</i> amphitheatre, is the usual halting station, named Mandràrahôdy, or Ambôdinangàvo, a Hôva village at the foot of the western ridge of the mountain range of Angàvo. Supplies of rice and cattle are here obtainable. The valley is fertile, tolerably well inhabited, with villages and homesteads, cattle enclosures, fields, interspersed with plantations and gardens. Ambôdinangàvo has 3,000 feet elevation. |
| Mandràrahôdy or Ambôdinangàvo | 6 | .. | |
| Mount Angàvo..... | .. | .. | |
| Day's journey..... | | 26 | Môramànga to Angàvo on map measures 20 miles. |
| Total | .. | 178 | |
| IMÉRINA. | | | <i>Tenth day's march, Angàvo to Ambàtomànga.</i> |
| Pass over Angàvo | .. | .. | The Angàvo pass has to be now surmounted, and there is some severe climbing as well as various ascents and descents through ravines to be accomplished, following the course of the river Mandràka, which stream flows by a tortuous route into the Mangôro, densely wooded. At last the watershed of the ridge is surmounted after a long climb, the total ascent from the foot of the great chain to this inner edge of the plateau is 1,620 feet (<i>Mullens</i>). Dupré gives highest point of Angàvo range as 4,346 feet. |
| River Mandràka | .. | .. | At 7 miles Ankèramadìnika is reached, a regular halting station and Government post,—besides a small market village, the first village in the province of Imérina proper. Passing through several valleys and over stony ridges, the region of forest has been left behind, and the route leads across bare open downs from which enormous tors of granite and gneiss crop out. The large basin of Manjàkandràna, with its clusters of villages, three or four churches, and cultivated fields and threshing-floors. |
| Ford | .. | .. | |
| Ankèramadìnika | 7 | .. | Angàvokèly, a noble mountain, 5,925 feet high, is passed to the north, and to the south are the so-called "Three Sisters," both remarkable land-marks. After passing the village of Ambôhikàma at last Ambàtomànga appears, by far the most imposing of any of the villages yet seen. |
| Manjàkandràna | .. | .. | |
| Mount Angàvokèly ... | 9 | .. | both remarkable land-marks. After passing the village of Ambôhikàma at last Ambàtomànga appears, by far the most imposing of any of the villages yet seen. |
| Mount Andôsirivo..... | .. | .. | |
| Ambôhikàma | .. | .. | both remarkable land-marks. After passing the village of Ambôhikàma at last Ambàtomànga appears, by far the most imposing of any of the villages yet seen. |
| Ambàtomànga | 5 | .. | |
| Carried forward. ... | 21 | 178 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| ANGAY. | | | |
| Brought forward... | 21 | 178 | <i>Tenth day's march—continued.</i> It presents an important and picturesque appearance. Angavo to Ambatomanga direct by map is $17\frac{1}{2}$ miles. |
| Day's journey..... | | 21 | |
| Total | .. | 199 | |
| | | | <i>Eleventh day's march, Ambatomanga to Antananarivo.</i> |
| Yedien, village and arched bridge | 3 | .. | Leaving Ambatomanga and its numbers of pits for fattening cattle, and crossing bare downs, a descent occurs leading to the village of Yedien, where a small but remarkable single-span arched bridge is thrown across a small stream flowing south, one of the sources of the Ikôpa river. There is here plenty of cultivation, the fields enclosed by banks on which are hedges of a small prickly <i>Euphorbia</i> . |
| Ambôhimànambôla ... | 4 | .. | Ascending another down, Ambôhimànambôla, the first view is obtained of Antananarivo, the capital city of the Hôvas, distant some 8 miles as the crow flies, and prominent from its high position. The country here is quite open and hardly a tree to be seen except an <i>amôntana</i> or <i>divavy</i> , &c., which are generally grouped in each village. |
| Betâfo..... | 5 | .. | If on an official journey, it is usual to halt at Betâfo until permission is obtained to enter the city, distant 5 miles. |
| Antananarivo..... | 5 | .. | Ambatomanga to Antananarivo direct by map is 15 miles. |
| Day's journey..... | | 17 | |
| Total from Tamatave . | .. | 216 | |

Colonel Middleton's estimate was 225 miles in 12 days, at the rate of $18\frac{3}{4}$ miles a day. Lieutenant Oliver's estimate was 216 miles in 11 days, at the rate of $19\frac{3}{4}$ miles a day. Admiral Gore-Jones's estimate was 212 miles in 15 days, at the rate of 14 miles a day; return journey, 215 miles in 10 days, at the rate of $21\frac{1}{2}$ miles a day. Average from above estimates, 217 miles at $18\frac{1}{2}$ miles a day. As the difference between going and returning is great, it may be fairly estimated that the *màromita* can carry a traveller up to the capital at the rate of 15 miles a day, and do the return journey at the rate of 20 miles a day, *i.e.*, fourteen days going up and eleven coming down. Some gentlemen travelling alone have done the journey in six days. It has been performed in *five*.

ROUTE NO. 2.—ITINERARY FROM ANTANÀNARIVO TO MOJANGÀ.

The Ikôpa line.

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|---------------------|--------|---|
| | Inter-mediate. | Total. | |
| IMÈRINA. | | | <i>First day's march, Antanànarivo to Fihaònana.</i> |
| <i>Antanànarivo</i> | .. | .. | Antanànarivo, 4,790 feet elevation. The route throughout is generally north-west, and for the first 3 or 4 miles, after leaving the city market, leads across rice-fields until a salient angle of the river Ikôpa is reached, thence following the northern embankment in the direction of the stream whose course here is also north-westerly. |
| <i>River Ikôpa</i> | 3 | .. | |
| <i>River Màmba</i> , joins River Ikôpa on right bank. | 4 | .. | Four miles farther on the river Màmba (Crocodile river) flowing from the east joins the Ikôpa by three channels, which have to be crossed; and on the same bank (viz., the right), and to the north of the track on the bank of the river, is a long ridge (fully commanding the path), which bears on its summit the strategically important town of Abôhidratimo. |
| <i>Abôhidratimo</i> | 1½ | .. | [Abôhidratimo at present only contains 300 houses, but it is the head-centre of a populous district. It was originally one of the twelve royal and sacred cities of Imèrina, and occupies the crest of the ridge above a mass of granitic boulders. It is marked by a conspicuous <i>amòntana</i> tree, which is plainly visible all over Imèrina. It would therefore form a good signalling station. There is a flourishing mission established in this place.] |
| Good signal station... | .. | .. | Leaving this town on the right, there is a great deal of swampy marsh to be traversed, covered with a species of papyrus rush (<i>hèrana</i>), which is used for thatching purposes by the natives, and of which fascines could be constructed. The volume of water in the Ikôpa is now increased by an affluent on the left bank which flows from the south, draining the Bètsimitàtatra plains. This affluent is named the river Sisàony. Still following the right bank of the Ikôpa for 4 miles, the path deviates so as to skirt the noble |
| <i>River Sisàony</i> | 2 | .. | |
| Carried forward.... | 10½ | .. | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| IMÈRINA. | | | |
| Brought forward .. | 10½ | .. | <i>First day's march—continued.</i> |
| Ambòhimandà Hill... (Signal station.) | 4½ | .. | hill of Ambòhimandà, which also forms a great landmark, and therefore useful signalling station. |
| River Andròmba or Katsaòka. | .. | .. | South of Ambòhimandà a considerable stream, the river Katsaòka or Andròmba, flows from the Ankàratra mountains into the river Ikòpa, 2 miles off the track which rejoins the bank of the Ikòpa at a convenient halting-place,— Soàvinimèrina, the half-way resting-place towards Fihaðnana. |
| Soàvinimèrina, mid- day halting site. | 3 | .. | From Soàvinimèrina the course of the Ikòpa river, which is now of considerable importance, directs itself nearly due west, and is joined by another affluent stream (unnamed in map) on the right bank, and at this junction are the celebrated Falls of Fàrahàntsana. |
| Falls of Fàrahàntsana | .. | .. | On leaving Soàvinimèrina the track diverges from the main river, crossing the un- named and small affluent before men- tioned some 2 miles above the junction and falls, and on the northern bank of which rises the ridge of Ambòhimirimo, which marks, somewhat indistinctly, the frontier between the province of Imèrina and that of Vònizòngò. |
| VÒNIZÒNGÒ. | | | |
| Ambòhimirimo, sum- mit of ridge. | 3 | .. | After crossing the ridge the broad valley of Vònizòngò is entered, the first village being Vangaina, beyond which the river Anjomòka is forded, and after passing the hamlet of Ampàribé another, small tri- butary stream, the Àsinabé, is reached, which after junction with the former flows westerly into the main stream of the Ikòpa, whose banks are here at least 10 miles westward of the track. |
| Vangaina | 2 | .. | From hence endless rice-fields are passed on very narrow paths and the course is more northerly. A few more unimportant brooks, chiefly useful for purposes of irri- gation, are crossed, and the ground rises from Ambòhipiaïnana up the banks of a watercourse to Fihaðnana, completing the first stage from the capital towards the north-west coast after eleven hours' journey, including the halt for mid-day meal. Elevation, 4,450 feet. |
| River Anjomòka | 2½ | .. | |
| Ampàribé | .. | .. | |
| River Àsinabé | 2½ | .. | |
| Ambòhipiaïnana | 2½ | .. | |
| Fihaðnana | 3½ | .. | |
| Carried forward.... | 34 | .. | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| VONIZONGO. | | | |
| Brought forward .. | 34 | .. | <i>First day's march—continued.</i> Fihaonana is distant from the capital direct as the crow flies 30 miles in a north- westerly direction. |
| Day's journey..... | | 34 | <i>Second day's march, Fihaonana to Ankàzobè.</i> |
| Fihaonana | .. | .. | Leaving Fihaonana in a northerly direction, the small villages of Ambòhitrimàmba and Isanòavèla are passed on the left, and the track leads up to the high moors, several minor streams being forded <i>en route</i> . The ground ascends, passing several clusters of villages, Antanòtibè and Andramanjàka, up to the crest of the great ridge of Ambòhimànga, which here curves towards the east, at an elevation of 4,600 feet above the sea. On this plateau, distant 5 and 12 miles to the west respectively, are the villages of Sambaina and Fierèrana, important church stations; while to the east on the bank of the Andrànobè river are popu- lous villages of the northern Vònizongo. |
| Antanòtibè | 8 | .. | At Ambàtomalàza the route commences to descend over the edge of the ridge to a lower level some 700 feet, and the valley of northern Vònizongo is entered. This is a long level valley between two pleasant lines of hills, drained by the river An- drànobè. On the left is the fine ridge of Ambòhidambinana, with a large village, Ambòhijàfy, at its foot on the left bank of the stream, along which the track leads; while on the farther or east side of the valley is Tsiàfabalàla, a conspicuous hill, fit for a signalling station, with villages at its base. Other small villages are also scattered throughout the valley. |
| Andramanjàka | 2 | .. | |
| Ambòhimànga ridge .. | 1½ | .. | |
| Sambaina | .. | .. | Proceeding farther north for half a dozen miles ¹ along the left bank of the An- drànobè, a curious and sudden bend of |
| Fierèrana | .. | .. | |
| Ambàtomalàza | 2 | .. | |
| Ambòhidambinana ridge | .. | .. | |
| Ambòhijàfy | 3 | .. | |
| Tsiàfabalàla | .. | .. | |
| (Ambàdambaina.) ... | | | |
| River Andrànobè | 20½ | .. | |
| Carried forward.... | 20½ | 34 | |

¹ There is a discrepancy in the description of route as in Mullens's map. Ankàzobè is placed close to the curious bend of the river, yet he says he halted at Ambòhitròmba and had a pleasant and easy journey afterwards; he does not state how far or for how long.

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| VÒNIZÒNGO. | | | <i>Second day's march—continued.</i> |
| Brought forward .. | 20½ | 34 | the stream takes place, and it has to be crossed twice. A few villages are passed beyond this bend of the river when Ambòhitròmby is reached. Mid-day halt. [The river Andrànobè rises on the northern slopes of Adràngitra, east of Lòhavòhitra; thence it flows in a north-west direction through the populous valleys near Ambòhitrolona, with their numerous churches, and rounding the promontory of Ambòhitrandriana's eastern shoulder drains the northern Vòni-zòngo, and taking a sudden bend to the west near Ambòhitròmby flows westwards into the Ikòpa, 10 miles west of the track.] |
| Ambòhitròmby | ½ | .. | |
| Tend. Ambòhitrand- riana. | .. | .. | A pleasant and easy journey [of which no details are given by Dr. Mullens] brings the traveller to Ankàzobè, at an elevation of 3,830 feet, completing the second day's march from the capital, distant 50 miles south-east. Ankàzobè has only fourteen houses surrounded by deep fosses and high cactus hedges, full of dust and pigs, a chapel with falling wall, clumsy window frames and no windows. Cold at night in July. |
| Ankàzobè | 6 | .. | |
| Day's journey..... | | 27 | |
| Total | .. | 51 | |
| NORTH VÒNIZÒNGO. | | | <i>Third day's march, Ankàzobè to Kinàjy.</i> |
| Mount Angàvo (suit- able signal station) | .. | .. | From Ankàzobè the pathway leads under the east flank of Mount Angàvo, whose ridge attains an elevation of 4,880. The summit is well suited for a signal station, as from hence a vast prospect is obtained over a treeless empty wilderness,—the only population existing in the long valley of the Andrànobè in North Vòni-zòngo. [The whole district is within the region of the sedimentary clay; the valleys have been scored out of it by water, and naturally the clay hills are of one height. Looking over the eastern ridge in the direction of the Anàtivòio not one prominent hill is discernible, all the summits being of one uniform height. To the west it is just the same. The only exception is in portions of ridges like the Angàvo mountain. This is a grand mass of gneiss, and the bluff at its |
| Carried forward.... | .. | 51 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|---------------------|--------|--|
| | Inter-mediate. | Total. | |
| | | | <i>Third day's march—continued.</i> |
| NORTH VÒNIZÒNGO. | | | northern end is a lofty perpendicular precipice, one of the finest in the country. North of Angàvo the next ridge is unbroken, the valley of North Vònizòngo being completely shut in; part of the waters escape down the Andrànobè on the south-west, the remainder, swirling round the precipice at the head of the ridge, cut a hollow in the northern hills, and escape along the west side of Angàvo in the river Antràmbo. Angàvo ridge and others parallel to it trend off to the south-west. To the south Tsi-àfo-balàla and Lòhavòhitra are conspicuous points.] |
| Brought forward... | .. | 51 | At 6 miles the hamlet of Måndrosòa is reached, and rounding the base of the mountain the river Antràmbo is reached and crossed near the village of Antàndrokòmby, which contains 40 houses and is overhung by the northern precipices of Mount Angàvo. The river Antràmbo, like all those before mentioned, is a tributary of the Ikòpa, the main river, which flows nearly due north some 20 miles off, parallel to the track. After a few miles a good halting station is obtained at Mahàridàza. (4,440 feet.) It is a village of 42 houses, with countless herds of swine. |
| Måndrosòa | 6 | .. | |
| River Antràmbo | .. | .. | On leaving Mahàridàza the course lies up the inner bend of a long valley, and a somewhat steep ascent leads over the pass of T. Ambòhimèna at 4,800 feet elevation. [Nowhere are signs of recent upheaval; the entire country is sedimentary clay, which has buried and enveloped the gneiss ridges and boulders of an earlier time, now cut and scored to great depths by the action of water. To the east and west the tops of the hills are of the same height. To the north the clay has given way. This red hill of Ambòhimèna and the ridge to which it belongs is the edge of the Vònizòngo terrace. On the north side the ground begins rapidly to fall. This descent is patent to the eye, and it shows itself in two parallel valleys, divided by a remarkable line of conical hills.] |
| (Lazaina). | .. | .. | |
| Antàndrokòmby | 7 | .. | |
| (Andrainarivo). | .. | .. | |
| Mahàridàza (halting place). | 5 | .. | |
| T. Ambòhimèna Pass (summit of peak, 5200 feet). | 7 | .. | |
| Tsàafàky | .. | .. | |
| Carried forward.... | 25 | 51 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| NORTH VÒNIZÒNGO. | | | |
| Brought forward .. | 25 | 51 | <i>Third day's march—continued.</i> It takes less than three hours from Mahàridàza to reach Kinàjy at 4,100 feet elevation. [The town of Kinàjy is the first of a series of military stations, five in number, in the direction of the Sàkalàva country, and along the line of easiest access. They form a series of defensible posts, within easy communication at intervals of from 6 to 10 miles, and small clumps of houses are found in their neighbourhood. Each of these posts has its commander, Government house, and garrison. Each is at the same time a great cattle station and depôt, and immense herds belonging to men high in authority in Imèrina are fed and tended in their neighbourhood. The <i>kraals</i> in which they are kept are very large.] Kinàjy consists of 68 houses placed on the spur of the hills, having many deep gullies on its northern side. On the south it has a double gateway, and each gate can be closed both with poles and stones. |
| Kinàjy | 8 | .. | |
| Day's journey | | 33 | <i>Fourth day's march, Kinàjy to Ampôtaka.</i> The moment Kinàjy is left the ground begins to fall, and the country throughout is very easy to traverse. The route strikes north-east over a fine valley, and at an opening between two conical hills arrives at a little winding river named the Mânankàzo, ("that which has wood"), the only bushes and trees being found in the ravines of this otherwise dry clay country. This stream rises in the hills near Vòhilèna to the north of the Anàtivòlo. On the banks and along the foot of the hills there are quantities of various sedges and long species of grass and reeds. Passing to the eastward over the shoulder of these rounded hills the track leads through another valley between high parallel gneiss ranges, with a rough and rocky edge. A stream of clear water comes out of the eastern hills of Mâritsipòy, called the Firìngalàva, and the path crosses many |
| Total | .. | 84 | |
| R. Mânankàzo | 6 | .. | |
| (Kiangàra.) (T. Ambòhitròlomanana.) | | | |
| Mâritsipòy Hills | .. | .. | |
| River Firìngalàva.... | 5 | .. | |
| Carried forward.... | 11 | 84 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| NORTH VÒNIZÒNGO. | | | <i>Fourth day's march—continued.</i> |
| Brought forward .. | 11 | 84 | streamlets rushing down to join it, and, following down with the current to the north-west, reaches Ambòhinòrina. Ambòhinòrina, the second of the Hóva frontier stations, contains 50 houses and a chapel, and is duly enclosed with the ditch, wall, and gates. It is garrisoned and commands the valley of the Firìngalàva. |
| <i>Ambòhinòrina</i> | 4 | .. | |
| Basin and ravine | 4 | .. | Following the stream north, 4 miles farther on is a deep basin which ends in a ravine, down which the river runs. A ridge is climbed on the right bank, and the route lies between two fine mountains, viz., Sàhàfàsika to the west, 4 miles in length, and Ambòhibè on the right. Both these mountains can be observed from Mount Angàvo (see <i>ante</i>). The double head of the latter, Ambòhibè, makes it a conspicuous object for many miles. [Distance for signalling from Ambòhibè to Angàvo, 30 miles.] |
| <i>Mount Sàhàfàsika</i> .. | 4 | .. | |
| (<i>Tsinainòndry</i> .) | | | |
| <i>Mount Ambòhibè</i> | .. | .. | |
| (Good signal station.) | | | |
| <i>Ampòtaka</i> | 9 | .. | The path keeps under the flank of Mount Ambòhibè, over the right bank of the Firìngalàva, some 9 miles to Ampòtaka, the third garrison town, containing 30 houses, and in addition an immense cattle fold, filled with fine herds. The elevation of this Hóva station is 3,100 feet, showing a fall of 1,000 feet from the post of Kinàjy in 32 miles. |
| Day's journey | .. | 32 | |
| Total | .. | 116 | |
| | | | <i>Fifth day's march, Ampòtaka to Malàtsy.</i> |
| <i>Ampàrafàra</i> | .. | .. | Beyond Ampòtaka high ridges are encountered which offer serviceable observing and signalling stations, but over which the east wind sweeps with violence in July (<i>i.e.</i> , winter). From one point on Ampàrafàra hill deep valleys are looked down upon, over Tiavòly, and the gneiss and granite-ridged terraces of Ampàravòla, which looks down on the east bank of the Ikòpa river, and the hills are very fine in all directions. At 7 miles the upper edge of a waterfall is passed, and a rapid descent made into the valley of the Màmamòkamita ("that which makes mosquitoes to cross") river, which, having |
| <i>Tiavòly</i> | .. | .. | |
| <i>Ampàravòla</i> | .. | .. | |
| Waterfall | 7 | .. | |
| <i>River Màmamòkamita</i> | 4 | .. | |
| (<i>T. Mavoandro</i> .) | | | |
| Carried forward. ... | 11 | 116 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| NORTH VONIZONGO. | | | <i>Fifth day's march—continued.</i> |
| Brought forward .. | 11 | 116 | its rise in the moors to the south-east, here cuts deep and falls in a fine cascade in a deep glen or chasm through the ridge of Anjàvona. The scenery here is bold and pleasing, and after 4 miles along the right bank an open level amphitheatre is reached, in the centre of which stands Màngasoàvina, the fourth of the Hóva frontier posts. [Màngasoàvina is a pleasantly situated town of 80 houses, enclosing a (<i>ròva</i>) Government house, and stockade, with abundance of cattle, pigs, and fowls. The valley basin in which this station stands is 8 miles across; the land is grassy and level. Several villages were in sight, and the number of houses in these villages and the town together is estimated at 400.] The elevation is 2,635 feet, and the <i>locale</i> is well suited for the camping-ground of a considerable force. |
| Anjàvona ridge | .. | .. | Proceeding on for 5 miles a fine gneiss hill, Andriba, which forms the northern boundary of the level plain, is rounded on its east flank, when a second level and broad valley is crossed, and here there are fine clumps of the <i>rofia</i> palm, and a few traveller's trees (<i>Urania</i> sp.) There are plenty of rice-fields, well cultivated, with numerous small villages. This spacious valley is drained by the river Kàmolàndy, which, like the former streams crossed by this route, falls into the Ikòpa river, whose main stream is now about 15 miles to the west. A mile beyond the river is the fifth and last of the Hóva garrison towns, Malàtsy, at an elevation of 2,550 feet. |
| (<i>T. Talompe</i>). | | | |
| Màngasoàvina | 4 | .. | |
| (<i>Màrohàrona</i> .) | | | |
| (<i>Andrànovèlona</i> .) | | | |
| (<i>Tsiàfakarivo</i> .) | | | |
| (<i>Manàkona</i> .) | | | |
| Camp ground | .. | .. | |
| Andriba Hill | 5 | .. | |
| River Kàmolàndy | 9 | .. | |
| Malàtsy | 1 | .. | |
| Carried forward. | 30 | 116 | Malàtsy contains 60 houses, whilst on the slopes without there may be some 90 more, and about 100 others scattered about the valley, in the centre of which is a Sàkalàva village. The Hóva frontier proper terminates here. Beyond Malàtsy and the scattered houses in the neighbourhood is a belt of country commonly termed "no-man's land," or the wilderness or desert. This region is altogether unpeopled, and forms the debatable border ground between the |

| Province and places on or near the route. | Distances in miles. | | Description of route and neighbourhood. |
|---|---------------------|--------|---|
| | Inter-mediate. | Total. | |
| NORTH VÒNIZÒNGO. | | | <p><i>Fifth day's march—continued.</i> coast tribes and the more civilized tribes of the interior, extending in a ring at an elevation between 2,000 and 1,000 feet more or less connectedly all round the island. There is no rice and no cultivation. Lying as it does between the highland tribes of the Hóvas and Bétсилéo and the Sàkalàva of the plains on the coast, between whom until quite recently there has ever existed a perpetual feud, no permanent settlement or habitation and cultivation would be safe from either side, and as the resort of criminal outcasts and runaway slaves the transit across this region has always been considered hazardous, and doubtless stragglers would run a great risk, but more from want of food and assistance than bodily injury.</p> <p><i>Sixth day's march, Malàtsy to Andrànobè.</i> Beyond Malàtsy the course during this and the following marches passes through a pleasant country, anything but desert to the eye, well watered with plenty of running water and gently-sloping hills and dells covered in great part with woods, and bounded on the westward by the Ikòpa river, now a noble stream of imposing dimensions, but with rocky bed of steep gradient, approaching its junction with the Bètсibòka river. This district narrows as the heads of the delta between these two rivers converge. At Malàtsy the Ikòpa is 15 miles to the west, and the Bètсibòka runs 27 miles to the eastward, both uniting 45 miles as the crow flies north by west from Malàtsy.</p> <p>[The track lies over long valleys, over first one pass and then another, or over hard clay ridges sprinkled with quartz gravel, and then along some clear stream bordered with fresh green wood. The valleys were simple and open and very green. The <i>rofia</i> palm grew more abundantly, and there were varieties of acacia with bamboo <i>palm</i> and the <i>dabo</i> (sp. fig-tree), as well as the bamboo <i>cane</i>, wild citron, and, as usual, quantities of strong coarse grass. All the</p> |
| Brought forward .. | 30 | 116 | |
| Day's journey..... | | 30 | |
| Total | .. | 146 | |
| Delta formed by Bètсibòka and Ikòpa rivers. | .. | .. | |
| Carried forward.... | .. | 146 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| NORTH VONIZONGO. | | | <i>Sixth day's march—continued.</i> |
| Brought forward .. | .. | 146 | streams cut their way to the rock, forming deep gullies in the ubiquitous red clay.] |
| Ambôhilôsy ridge | .. | .. | The road at first runs north-east parallel to the Ambôhilôsy (leaving the last village, Soàvinandriana, under Ikàto hill, some miles away to the right), strikes the sources of the Andrànobè at Ambôhimèna, and follows the left bank of the stream, continually descending. The best site for a mid-day halt is at the Pass of Màrokolôsy, over which the ridge is bold and high, and suitable for a signalling station. A second ridge is next crossed called Kàlomainty, 1,290 feet, whence a descent brings one into the green valley of the Ampàsoria river. [At the north end of this valley the long grass was found burning by Dr. Mullens, a proof that the Sàkalàva are in the habit of tending their cattle with the young grass which springs up after the dry grass is burnt.] |
| Soàvinandriana..... | .. | .. | |
| River Andrànobè | .. | .. | |
| Ambôhimèna | 8 | .. | |
| Màrokolôsy Pass | 7 | .. | |
| Signalling station | .. | .. | |
| Kàlomainty Pass | 4 | .. | |
| River Ampàsoria | .. | .. | |
| Camp ground on the Andrànobè. | 10 | .. | A third ridge has now to be crossed, 1,240 feet, after which the traveller passes down a rocky valley and enters a piece of country like an English park, well watered by the river Andrànobè. The flies are found to be troublesome in these valleys. The shoulder of a hill is now turned between two bends of the Andrànobè, and the camping-ground is found conveniently situated on the left bank of the western arm, within 5 miles of the great rapids of the river Ikôpa. Elevation not given, estimated at say 1,040 feet. |
| Day's journey | — | 29 | |
| Total | .. | 175 | |
| | | | <i>Seventh day's march, Andrànobè to Mèvanàna.</i> |
| Mènavàna Plains | .. | .. | Crossing the river Andrànobè, the track follows for a space of 4 miles the rocky valley of that river, and the bottom of the hill country was visible, the plains of Mènavàna stretching away to the distant horizon. The banks of the Ikôpa at Antànimbàrindratsontsòraka are here reached, and followed for several miles past rapids and islands to Anòsifito, a notable group of seven islands in the bed of the stream. The track now turns a little inland and crosses a small stream, the Andrànobè— |
| Antànimbàrindrat- sontsòraka. | .. | .. | |
| Anòsifito or Seven Islands. | 4 | .. | |
| River Andrànobèvàva | .. | .. | |
| Carried forward.... | 4 | 175 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| NORTH VONIZONGO. | | | <p><i>Seventh day's march—continued.</i></p> <p>vàva, and arrives upon a region of wild disorder. Here the gneiss strata have been tilted perpendicularly, and hills of quartz, gneiss, and clay have been thrown up, made up of fragments of the primitive rocks. The country is covered with countless boulders, many of which are of enormous size. Multitudes of these huge waterworn masses are half-buried in the clay. This soil is the drift and <i>débris</i> of the higher districts. The present Ikôpa river bed and ravine indicates the line of the valley down which the drainage of Imèrina has poured for countless ages, and it is here that the material brought down from the hills has been deposited upon the plains. Enormous forces have evidently been at work; the result of mighty floods and the outpouring of lakes by the rending of barriers are everywhere stamped upon this widespread scene of ruin. It takes four hours' traversing without any source of potable water being procurable, so that the bearers suffer much from thirst. At last a beautiful glen is reached on the north edge of the drift, down which flows a stream of pure water, which has its sources in Tainanjidina, the Anàndronjia. Crossing this stream, the high banks of the Ikôpa river are followed for several miles to Mèvatanàna. Mèvatanàna justifies its name, which means "an excellent site for a city." It stands on a spur of that inner ridge of clay through which the Ikôpa has cut its way, and has deep ravines on three sides. The town is 240 feet above the sea-level; the river is 150 feet. This somewhat important town contains 168 houses, of which 80 are within the stockade. The governor's house is in a broad open square, close to which are the principal shops for cloth, meat, vegetables, and fruit. The town occupies an admirable position in relation to the country generally. It stands on the edge of the hill districts and of the fertile plains. It is 2 miles from the right bank of the river, at the point to</p> |
| Brought forward... | 4 | 175 | |
| Plain of drift and boulders. (<i>River Mènavàva.</i>) | .. | .. | |
| <i>Tainanjidina</i> | .. | .. | |
| <i>River Anàndronjia</i> ... | 10 | .. | |
| <i>Mèvatanàna</i> | 7 | .. | |
| Carried forward... | 21 | 175 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|--|---------------------|--------|--|
| | Inter-mediate. | Total. | |
| | | | <i>Seventh day's march—continued.</i> which the river is navigable for canoes. It is a good stopping station for all travellers from the coast, and the first resting-place to others journeying from the capital. It is also the edge of the inhabited belt. To the east and south the country is empty. Across the river to the west the district contains a few Sàkalava villages, of 3, 5, or 7 houses, at long intervals. It is the most southerly of the six fortified Hóva posts which end with the port of Mojangà. A considerable number of the inhabitants of the town are the Hóva garrison from Imèrina. Below Mèvatanàna and above the influence of the tides the shallows are more numerous and formidable, and from this post it is usual to hire canoes and continue the journey down the Ikôpa river by water. From Mèvatanàna upwards all the upward trade must go by land, a distance of 150 miles across country by map, and, as above estimated, at least 196 miles by the track, which has, if anything, been rather under than over-estimated. |
| NORTH VòNIZòNGO. | | | |
| Brought forward .. | 21 | 175 | |
| Day's journey | | 21 | |
| Total..... | .. | 196 | |
| AMBòNGO. | | | |
| (Left bank of Bètsibòka.) | | | <i>Eighth day's march, Mèvatanàna to Kàrambily.</i> |
| Mèvatanàna | 2 | .. | Mèvatanàna is 2 miles from the point of embarkation on the east bank of the River Ikôpa, and from hence it is usual to proceed by water in canoes. [The route by land follows the course of the river at a distance of from 5 to 8 miles, and will be described in Route No. 3 following. The River Mèndràva enters the Ikôpa on the left bank.] It is not easy to procure many canoes of any size. The average size of a large canoe is about 40 feet long and over 3 feet broad, and these vessels will carry 43 men. Here the river is about 300 yards broad, but shallow and full of islands. Three miles on the islands cease to appear, and two long reaches to the north and west are traversed. Astonishing numbers of cro- |
| (Place of embarkation.) | | | |
| River Mèndràva | .. | .. | |
| Canoes. | | | |
| (Ibèràsimànana.) | | | |
| (T. Ampànazàva.).... | | | |
| Carried forward.... | 2 | 196 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| AMBONGO. | | | <i>Eighth day's march—continued.</i> |
| Brought forward .. | 2 | 196 | codiles are ever to be seen in groups on the sandbanks all the way down the river. |
| Ambinany..... | 10 | .. | A resting-place is found at Ambinany, a village on the left bank, and marked by a noble tamarind tree. A mile farther on the waters of the Ikôpa flow into the more important river Bêtsibôka, and the united streams, keeping the name of the larger, the Bêtsibôka, flow on to the sea. At the junction the Ikôpa is a quarter of a mile broad, whilst the Bêtsibôka is much broader; and in the rainy season tremendous floods throw the Ikôpa's waters far into the western bank and produce the broad sands whose banks are bare in the dry season. |
| Junction of the Ikôpa with the Bêtsibôka River. | 1 | .. | Four miles away to the east is the town of Amparihibé ("at the big lakes"), standing prominently on its clay hill. Proceeding down the river, past Betanimàhamày, over broader but not deeper waters, the course is somewhat tortuous. The banks are covered with vegetation, and here and there the trees are of considerable size. The course is north-west, and the speed of the canoes is about 4 miles an hour with the current, which flows strongly. Beyond Betanimàhamày is the village of Ambàrambè under Mount Tsitôndrona. |
| (Ambàtovàto.) | | | |
| Amparihibé | .. | .. | Twenty miles down the Bêtsibôka from its junction is the halting place of Kàrambily, a small Sàkalàva village; and 6 miles to the east, on the opposite side of the river, is Ankoàla. |
| (See Route No. 3.) | | | |
| Betanimàhamày..... | 14 | .. | Since leaving Mèvatanàna the country passed through is held by semi-independent tribes of the northern Sàkalàvas down to the sea-coast. Its features are well-defined, the granite hills and their long spurs forming an inner boundary to the broad and beautiful plains. It is everywhere beautifully green. Warm in climate, it has tropical vegetation, including the fan-palm, the tamarind, the mango, together with fruitful plantains. The grass is rich for the many herds of cattle; and the enclosed basins and undulating plains seem capable |
| (On left bank.) | | | |
| Ambàrambè | .. | .. | |
| Mount Tsitôndrona .. | .. | .. | |
| Kàrambily | 6½ | .. | |
| Ankoàla | .. | .. | |
| (See Route No. 3.) | | | |
| Carried forward.... | 33½ | 196 | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|--|
| | Inter- mediate. | Total. | |
| AMBONGO. | | | <i>Eighth day's march—continued.</i> |
| Brought forward... | 33½ | 196 | of producing roots, vegetables, rice, and tropical fruits. But the population is thin and scattered. The Sàkalàva villages consist of 10, 15, or 20 houses; and they are few and far between. The simple dwellings of the Sàkalàva people have a singular appearance, looking more like huge bird-cages, being formed of split bamboo and reeds, and quite open to the winds. The province on the left bank of the Bètsibòka is Ambongo, and that on the right Ibòina. |
| Day's journey | | 33½ | |
| Total | .. | 229½ | |
| | | | <i>Ninth day's march, Kàrambily to Bèmbatòka Bay.</i> |
| Kamòna or Kamòro River. | 5 | .. | Leaving Kàrambily, the canoes pass in an hour's time a small river, the Kamòro, which joins the Bètsibòka river on the right bank. |
| Tràbònjy..... (Bèsèva.) | .. | .. | Beyond it is another of the Hóva garrison towns, Tràbònjy, 5 miles inland, situated on a hill, and mentioned more particularly in Route No. 3. |
| Tsitòndrona ridge.... (Antàfikaràny.) (Màrohàla.) | 12 | .. | The main stream now takes a more winding course through the hills of the Tsitòndrona ridge mentioned in the previous day's journey, passing dark and thick woods under T. Ankàrafàtsy and luxuriant vegetation, long gardens of plantains and bananas, the plantations of the Sàkalàvas. Animal life is also more abundant. Egrets and flamingoes, pigeons, and <i>Nectarinia</i> abound, and many aquatic birds of the duck species rise in flocks at intervals. The effects of the tide are also here met with, although as yet some distance from the estuary at the head of Bèmbatòka Bay. |
| T. Ankàrafàtsy | .. | .. | |
| Estuary and shallow delta at head of Bèmbatòka Bay. | 10 | .. | |
| Mahàbo | 15 | .. | Fifteen miles lower down the town of Mahàbo is passed 4 or 5 miles inland from a fine broad reach, which opens into the marine estuary at the head of the bay. Mahàbo is on a conspicuous double-headed hill. |
| | | | The course is now nearly north, and a halt should be made at the mouth of a small river which runs down from the garrison town of Màrovoà (see Route No. 3), and |
| Màrovoà | .. | .. | |
| Carried forward.... | 42 | 229½ | |

| Province and places on or near the road. | Distances in miles. | | Description of route and neighbourhood. |
|---|------------------------|--------|---|
| | Inter- mediate. | Total. | |
| | | | <i>Ninth day's march—continued.</i> the salt water is attained. Here it is necessary to exchange the long narrow canoes for broader dhows to sail across the bay. Opposite the halting-place, under Màrovoà, in Ibòina, are two large islands covered with dense jungle, with mud-banks thickly interwoven by mangrove roots and quantities of the <i>Via</i> or Arum lily of gigantic size, similar to that which grows on the east coast under the same conditions. The open dhows are 30 feet long, 8 feet broad, and 6 feet deep, with broad stern partially decked with the ordinary Arab lateen sail. |
| Brought forward | 42 | 229½ | |
| Day's journey | | 42 | |
| IBÒINA. | | | <i>Tenth day's march, Bèmbatòka Bay to Mojangà.</i> |
| Mojangà..... | 27 | .. | |
| Day's journey | | 27 | |
| Total from Antanà- narivo | .. | 298½ | Under favourable circumstances the dhows sailing down the Bay of Bèmbatòka take about 10 hours to accomplish the distance of 27 miles from the mouth of the Bètsibòka to the port and town of Mojangà, after a journey of 298 miles from the capital. |

The direct distance from Antanànarivo to Mojangà as the crow flies is only 240 miles, of which 90 are by water as far as Mèvatanàna, and 150 by land direct; but taking into consideration the tortuous course of the river and the deviations and hills, valleys and gullies by land, the actual road cannot be far from 300 miles in round numbers. Again, these journeys have been accomplished by natives in the above number of marches, and messengers can do the same distance in eight days. Dr. Mullens, travelling comfortably with frequent halts, accomplished the journey in sixteen days from Vònizòngo *downwards*. Upwards, against the stream and with frequent ascents, at least eighteen days should be estimated for the ordinary traveller travelling in filanjàna.

From the upper plateaux of Imèrina and Vònizòngo the country above described is divided naturally into three sections, differing in a marked degree from one another. The first section includes the inhabited country, almost treeless, protected by the Hóva posts, and consists of four broad terraces, of which three mark very decided falls of the ground towards the sea. The course, however, leading obliquely across these terraces, and therefore over easy gradients to Malàtsy. Beyond Malàtsy comes the second distinct section of the journey, namely, the portions of uninhabited wilderness termed "No-man's land," prettily wooded and undulating, terminating in drift at the base of the hills. The third section comprises the cultivated plains and hills of the Sàkalàva coast tribes.

The CHAIRMAN (Admiral Jones): As we have got the prospect of seeing General Digby Willoughby very shortly, I suppose the generality of people would like to reserve their questions as to any information they may want till that event occurs, which will not be more than another week. It strikes me very forcibly that a very great blessing has come to the Hovas in disguise. This war that has gone on has been the grandest thing for the Hova nation that perhaps has ever occurred. When I was at Antananarivo four years ago, the troops were well trained then, spearmen and musketeers and all the rest of it, but there was no true teaching then at all. Now out springs this war, and the French send a perfectly inadequate force. They are not like our men in the East, not men like General Stewart had under him, who was ready in the torrid zone with 1,500 men to meet tens of thousands and put them to flight. Those are not the men they have got, and the consequence is, they failed altogether. I mentioned in my ascent to Antananarivo that I thought the Hovas were the best raw material I ever beheld for making troops; they were very active, could carry large loads, splendid wind and physique in every way, but further they were not taught. Now this has come about and we find that these troops have been encamped, subject to orders, well looked after and well armed—we had an account of their uniforms and all that sort of thing—and kept in perfect order, ready for service with the French enemy in front. Now that was the finest thing that could possibly have occurred to the Hovas. They are regularly trained now, which they never were before, and I take it if any other nation ever goes to have a tussle with them, they will find them a very different class of men to what they were. You recollect at the beginning of the American War the first battle in which the Federals fought the Confederates was a case of you run, they run, and running all the time—that was the battle of Bull's Run; but a short time afterwards the bloodiest battles that ever were fought were fought by the same men, because they were disciplined and taught how to do things; that will be exactly the case with the Hovas. I have no doubt the French will never put their feet there again in a hostile way. They have always been singularly unfortunate with the Malagasy; they have had many expeditions. It was originally colonized by the French 200 years ago, but the strange thing was the whole fighting then was down south; now it seems to have shifted right up to the north. Fort Dauphin in the south was for some years in possession of the French, but they eventually gave it up. We had a place colonized with 400 people, which some of the people ran away from the French place to go and see, and when they came there they found a graveyard and nearly 400 graves in it, and not an Englishman there. We had colonized it before the French, but we never were successful, because our great enemy was the climate. Now it is not that the climate is actually bad itself; I do not suppose it is very much worse than Mauritius; but it is that we have no knowledge how to inhabit it. It is like a basket of eggs, the whole of Madagascar, and the streams all run down through the fissures. The people live upon rice and other vegetables, which they grow where these streams are. The consequence is, they live in paddies; it is a kind of paddy-field. When I was up there I sometimes found my bed going down under me—it was so soft; that is the reason of the unhealthiness. When I went up there it never ceased raining; we were for six weeks in constant rain, but we never had a man sick, though we had 300 carriers. The hot weather brings fever of all kinds, and that is the reason the French appear to have been so unfortunate. No doubt it was a great mistake in France. They talked a great deal about it; it was very much discussed in Europe, and everybody felt that they were doing a wrong act when they were going to take Madagascar. They have no right on their side whatever, but they chose to go and we see the result. The result is, they have made the Hovas almost a warlike nation; they will be perfectly ready the next time they are attacked, and I have no doubt in the world that Madagascar may now be considered an independent country, because the fact of the French being there means nothing. I have been at Nôsy-Bé, and a more God-forsaken place I never saw in my life. It will be the same at Diego Suarez the moment *la Gloire* and everything else has gone; you will never hear anything about the French. I attribute the want of success of the French entirely to the country, because the country was very much against them, but there was also a want of *élan* in the troops. I do not think the Malagasy are a warlike race.

Whenever we have had to meet them, they seem naturally to have got the worst of it, and therefore I attribute rather more fault than our lecturer seems to do to the French. I do not think they had the go in them. However, that all remains in the future. One thing we may be all very much surprised at, that is, that the Malagasy, after contest with one of the most warlike nations in Europe, have come off victorious. It has been remarked that the Prime Minister agreed to pay too great a fine; but it is also said that he has discovered a gold mine, and that the fine is a mere nothing to him. I believe he is working that gold; I hope it is so with all my heart, because the one thing they do want is money. When I was out there they had no coin. We took a dollar, broke it up into little bits, and they weighed it with scales. Everybody took out his scales who wanted to buy anything. I believe that the Hova nation are the most educated people in the world. The missionaries have had them under their care; they have taught them reading, writing, and everything that could be taught them. They have got some of the standard works, and one gentleman who attended the Legation I was told had every standard work in the English language in his library, which he had read attentively. All the children as you went in and out sang hymns, and were very much like our own. Education will tell, because it brings out intelligence, and those people are extremely intelligent, and they will prove a very formidable enemy when they are properly drilled. I do not think we need have any alarm of the French having another expedition in our day. I was asked by an official of high standing in England whether we could not turn the French out of Diego Suarez if we chose, and said, "Why do we allow the French to seize what they have no right to?" They said the Hovas were independent and were declared to be independent after the taking of the French Islands, and the whole of the Sakalavas did homage to the King then reigning, and proclaimed that Madagascar was one island and he was the Sovereign. That has never been reversed, and no doubt the fact that the country is now allowed to be under one monarchy again is one of the great gains which the French have given us, because, after fighting them and after being beaten, they admit that all Madagascar is one island. If there is any gentleman here who would like to ask any question, we shall be very glad to listen, and we shall be very glad to hear the Bishop of Mauritius, who must know a great deal about that part of the world.

THE BISHOP OF MAURITIUS: I feel, Sir, that I have learnt a very great deal since I came into this room; we are very much cut off in Mauritius from any communication with Madagascar. I am sure that General Willoughby will be able to give you a great deal of information, as will also my *confrère*, the Bishop of Madagascar, who will shortly arrive in England. He was at the capital when all this occurred, but my inability to hear from him prevented my being personally acquainted with many of those details that have been so completely set before us to-day. At Mauritius, I must confess it strikes me we shall suffer a good deal from the occupation of Diego Suarez by the French, because we coal all the French mail steamers and the French men-of-war. I heard in Mauritius that the French claim a great deal more than the small adjacent territory that has been so very graphically described in this paper, but how far that is true I am unable to state. We hope that the opening up of Madagascar to a certain extent to civilization will afford our better class of Creoles what they need so very much at present, an opportunity of emigration into Madagascar. We are now in great trouble both in Mauritius and Bourbon, and are very anxious to find some employment for a number of our poorer Creoles of chiefly French origin, but at present we are informed that there is nothing fixed. No one when I left seemed to be aware of what was the real state of things, whether the French would leave Tamatave in another week or whether they were going to stay, and so forth. But we are hoping that numbers of our people may find something to do, and may open up the country to labour and commerce. I hear from all my friends there that the new generation of Malagasy is very much superior to the present one, and that whatever they have gained by the *prestige* that now accrues to them, will be utilized by the better-informed class of young persons who are coming up.

Captain BOYLE, R.N.: As one who has actually been on the coast a good deal, and who knows many of the places that are named, I should like to say that I do not

know whether those who are here to-day who have not been there, understand that the point called British Sound, at the top of the map, is the one that is spoken of as Diego Suarez. Although it bears the British name in all the charts, the French have altered it, because I presume they object to the term British Sound. I have been in that harbour, and no harbour in the wide world is easier to defend. The French have got hold of the very key of the position, there is no question about that. The point the people of England have failed to understand is that Diego Suarez commands the trade on both sides of that great island. Our Eastern trade, with the Suez Canal blocked, must go on this hand of Madagascar or on that hand, and you may have that noble harbour the British Sound, full of the enemy's cruisers, waiting to pop out and harass our trade, that is the point we shall not discover till we have the very best reasons to know it. We have allowed the French to get there, and I am afraid nothing can be done. It has not been without due warning. I know our Chairman has had his hand in the warning, as well as other people; but there is a sort of fatality that comes over a nation, they allow their trade to be interfered with in this kind of way, and then say, "Who would have thought it"? On the west coast the climate is very much better than on the east. The east coast is the worst for fever, but even on the east coast, to show you it is not a very bad climate, I may tell you that our boats used to cruise about, sometimes as much as a fortnight away from the ship, quite in the open, never landing, but going into all the harbours as they went along, and never any of them suffered; we never had any fever in consequence of that. On the west coast for years the boats of our cruisers have cruized off and in the harbours, and no special fever cases have occurred. At certain seasons Madagascar is a feverish place, but the fever the Malagasy talk about is a fever that goes off in about twenty-four hours. Everybody who has got a cold says he has the fever. Sometimes I know it is much more serious, but it frequently comes and goes in twenty-four hours, so that considering that it is in the tropics I do not think the fever is a great point to consider. Antananarivo is the point which M. Ferry described when he talked about the eagle fastnesses, in which the Hovas lived waiting for the French onset; they had chosen a point lying at a great height. The climate is infinitely better than on the sea coast, and there it is that they command the island. And why are they the dominant race? They are the dominant race clearly because they have the best climate, and in that way they have matured their race over the coast races. The coast races all round are inferior races, because, I take it, of the climate, and because also they are greatly crossed with African blood. The Hova, pure and simple, is a Malay. The coast tribes are Malays crossed with negro, and that is the whole reason why the Hovas are to-day the dominant race in Madagascar. They have kept apart from the negro races, and as long as they do that, they have shown the knowledge of their power, and that is what they will continue to do. I quite agree with our Chairman, that they have made themselves a nation which must be recognized as a factor in all future questions, but I cannot help thinking that the real difficulty we shall have is that having unquestionably beaten the French, they will have a conceit which will probably hinder their advancement. They have got now an idea that they are as good as the French and better. They always have been an extremely conceited race. Wherever you find a Hova you find the most conceited person under the sun, and naturally this is another element in their conceit. They will go about, and will probably have all the names of these long-named battles that Captain Oliver has alluded to on their colours, and when we go with the most ordinary questions to them they will say, "Oh, no, the victors of So and So cannot discuss that."

Admiral DE HORSEY: I am afraid I have very little if anything to say on this subject. My knowledge of Madagascar is limited to a visit to Tamatave, and to having cruized about in those waters. There are one or two questions which I certainly should have liked to ask the lecturer, and perhaps General Willoughby, if he had been here, would have been able to reply to them. I for one feel very sore at British Sound being called Diego Suarez. I noted when senior Officer in those waters in 1861-62, that the French always spoke of it as Diego Suarez. We called it British Sound, and I think we had a right to do so, because it was surveyed and so named by our own Admiralty surveyors. It is one of the finest harbours in

the world, and commands the west and east coast. And as if it was not enough for France to have established herself there, I read in the papers lately that they have established a protectorate over all the Comoro Islands, including Johanna. I think it is a great misfortune that our Government had not a word to say to that. Johanna has been our little coaling station. It almost belonged to England; we established it as a port for our ships for victualling and coaling. The Johanna people look upon us as almost proprietors. The British Consul there has virtually been King of Johanna for the last twenty-five years, and it is with a feeling of soreness I see our Government so blind to our interests abroad, going on with trumpery home affairs, and not knowing what is taking place elsewhere. It does appear that France has been taking a little advantage of us during our troubles in Egypt and elsewhere; this Madagascar business would never have occurred if our Government had been a little stronger, and if our Navy had been a little stronger. It used not to happen. We kept more ships in the Mozambique, and there was never any question of the French establishing themselves there in my time. The points I would like to ask the lecturer are whether it is true that all foreign nations are to deal through the French agent at Antananarivo. It is no use to say they have not a protectorate if they are going to compel all foreign relations with Antananarivo to pass through their agent. I should also like to ask whether the establishment ceded to them in British Sound means any sovereignty over that port. If it does not mean sovereignty, if it only means that they may have a coaling station or any other station they may like to have, I do not think it is of any consequence, but if it is sovereignty, I would hold it as a very serious matter. Here we have Mauritius, only some 400 miles distant from Madagascar, and dependent upon it for supplies. It is only a speck on the ocean compared with this enormous continent, for it is not an island but a continent 900 miles long, and when our gallant Chairman spoke of the climate as being indifferent, I think he overlooked the fact that in a large country like Madagascar the badness of climate is chiefly confined to the sea shore. I have always heard that at Antananarivo the climate is good. It is an enormous island, with every sort of climate, in some parts with mountains 7,000 or 8,000 feet high, so that you may almost choose your climate. I am sorry I cannot add to the information the lecturer has kindly given us, but as I started by saying, I have not had the advantage possessed by our gallant Chairman, of having visited the interior of the island.

Captain PASFIELD OLIVER: I think the best answer to Admiral de Horsey's questions would be made by General Willoughby himself, who has lately arrived from Madagascar as the Ambassador of the Queen of Madagascar. He wrote to me only a day or two ago, saying he was very sorry he could not be here to-day, because he was still down with Madagascar fever, but that next week or the week following he would be only too glad to be present. Under those circumstances I hope that we shall be able to get up an audience if this discussion is adjourned for his presence. I am sure there are a great many people who would have been here to-day if they had thought General Willoughby was to be present. My lecture has been drawn from sources which are open to everybody, the newspapers, from carefully reading up the subject, and from correspondents in the country, but none of this correspondence gives me the information which naturally General Willoughby has kept to himself, and I think it would be a good opportunity to hear General Willoughby on the subject. I shall ask the Chairman to propose Wednesday week for the adjournment of this discussion, when the General, as Ambassador, will be able to speak positively as to the claims of the French to Diego Suarez Bay. I have read the treaty, and according to my reading I think they have only a right to form coaling stations there. I do not suppose that they will ever have the right to fortify, and from information derived from my missionary friends and other correspondents in Madagascar, I certainly think that that is what the Hova Government means. I know the Hova Government are indignant at the idea that the French can possibly exercise any *protectorate*, and since their Queen has been allowed to be Queen of the whole island, the parting with a single inch of their territory has been a thing that they would die for. They simply allow the French, as far as my understanding goes, to form coal depôts and places for repairing ships. The limits are very strictly laid down in a letter which is attached to the treaty,

viz., four miles to the north of the deepest inlet of Diego Suarez, and one and a half miles west and south. That gives the Hova full access to the remaining portion of the peninsula, in which are several other harbours, one of which Captain Wharton, the Hydrographer, specially pointed out as being a famous harbour, and really more useful almost than Diego Suarez. With regard to the entrance to Diego Suarez, I am not a sailor, but I think Captain Boyle will confirm me when I say that he was outside Diego Suarez for some time without being able to get in, the entrance being so low and difficult to make out. There is a great equatorial current and south-east trade, and on the west side of Cape Amber, as far as my knowledge goes, you are quite out of that. There are hills close by, outside the French boundary, from which you can command the whole of Diego Suarez Bay; the Hovas have only to start a fort there, and I believe they can overlook the whole of the inlet. There are heights called by thoroughly English names—Dover Castle, Windsor Castle, and so on—all within range of the gulf of Diego Suarez, and outside the limits which the French propose to keep to themselves. M. de Freycinet, a first class statesman, has had a very difficult task in getting his countrymen to get away from Madagascar, and has had to study their susceptibilities. It was M. Jules Ferry who started the idea of Colonial extension and the conquest of Madagascar, whilst I do not think M. de Freycinet will attempt it. There is no doubt, however, our Government ought to be alive to the important events developing in the Indian Ocean, and certainly our naval forces in those waters should be at least equal to those of the French. In my paper I have given the number of ships which were there, and though Admiral Hewitt was perfectly prepared, had he had the chance, to go in at his vastly superior opponents, as Captain Johnstone was at Tamatave, the forces were quite unequal at that time, and the British squadron, now under Admiral Sir Frederick Richards, ought certainly to be brought up in strength and number of guns to match those that the French can bring against us.

The CHAIRMAN: There is one point which I omitted, but the lecturer has gone a little into it, which is this, that Mauritius and Bourbon are more or less dependent on Madagascar for their provisions. The products of Madagascar are very remarkable. I have got a paper here which will give you a list of them. They do a large trade in the export of cattle, and, as I say, Mauritius and Bourbon are more or less trusting to them for their best supply. That is one reason why we should never let Madagascar go out of our hands. Before I sit down you will allow me to give the thanks of this meeting to Captain Oliver. I am sure we are all very much obliged to him for his kindness in reading the paper to-day, and that we shall all receive very great instruction from it.

Adjourned Discussion, July 21, 1886.

The CHAIRMAN (Admiral Jones): Ladies and gentlemen, exactly a fortnight ago we met here to hear a very clever paper which was read by Captain Pasfield Oliver about Madagascar and the affairs which have recently gone on there. After his lecture we had a short discussion, but it was apparent to everybody that we could not do very well unless we had General Digby Willoughby present, who personally conducted a great many of the affairs that went on there, and was perhaps the only one person who could give us any real information. I am glad to say the General is now present. I am sure we are all delighted to find him safe and sound after all his adventures and in very fair health. Before I open the meeting to-day, I would like to remark on a few dates which will elucidate matters very much, and make us understand more thoroughly everything that is said. Madagascar was discovered by the Portuguese in 1506; King Emmanuel of Portugal in 1509 sent Lopez de Sequera and next year another Officer to report on the country and organize an establishment for trade. The son of a great chief was taken to Goa and also a great many of the natives for the purposes of education, and religion was introduced. They seem to have lasted a great number of years, but to have eventually died out, and in 1595 we find the Dutch founding establishments in

Madagascar, and the remains of those establishments exist to this day. In 1643 the French founded a "Société de l'Ouest" to trade with Madagascar under the patronage of Richelieu, and they established a Colony at Port Dauphin. They were then about 150 in number. The first French Governor was the Count de Flacourt, a very able man. He seems to have conducted the work remarkably well there, but nevertheless the Colony gradually got worse and worse, and eventually disappeared. But a curious thing occurred, that while that Colony was existing, several Frenchmen deserted and went to the English Colony, which nobody in England seems to know anything at all about. They had 400 men established at St. Augustine on the west coast, and when the Frenchmen arrived there they found the English Colony had disappeared, but there were 400 graves in the graveyard, and the few that survived found their way to India. The French finally quitted in 1672. In 1750 the French got possession of the Island of St. Mary, which was ceded to Louis XV, but the Governor and his people were all assassinated. In 1773 a Pole, Benyowsky, had a romantic kind of passage there. He was declared to be the son of a native, and was a very clever and able man, and he did remarkably well, and after some years in Madagascar, he went on the Continent of Europe and was very well received in France and many other places; but, strange to say, when he returned to Madagascar, he was shot by a French soldier in a fight, and that finished his career, which was a very remarkable one. In 1810 the English took Mauritius and Bourbon; troops were also sent to Foulé Point, and Madagascar was taken possession of by military occupation. This went on till 1817, when Madagascar was declared to be an independent country. Governor Farquhar came over from the Mauritius; they had a large assemblage of people, and the island was formally ceded to Radama I, and it has remained to Radama and his descendants from that day to this. The present young Queen is a lineal descendant of Radama I. In 1842 the French claimed the northern point, Cape Amber. Up to that time all their proceedings had been down at Port Dauphin, but now they claimed what was then called the English Sound—that was the name on the chart. After the war of 1810, Madagascar was, without question, English by right of conquest. Our troops were sent there and they occupied the positions, and our friends the French at that time certainly had no right of any sort or kind; but they made a sort of treaty with the Sakalavas, and they say, though we have had some difficulties about that point, that the Sakalavas yielded them the northern part of the island. On that question there has been a great difference of opinion, but out of that arose the war which is just over. They kept a diplomat in Madagascar. Now the difference between a consul and a diplomat is rather a curious one, because the diplomat has access to the ruling power and the consul has not, but they were the only Power that did keep a diplomat, and they had a good many quarrels even in my time with the natives while I was there. They eventually claimed the whole of the northern part, and hence came the war. I am not going to enter into the question of the war, as my friend the General is here, who will tell us a good deal about it. I merely mention those dates to show you that the matter has gone on from the days of Richelieu till now, and that the French were the fourth people that came and by no means the first. I will now ask Captain Oliver to state as succinctly as possible anything that he may have to say in reference to the discussion that took place on the last occasion.

Captain PASFIELD OLIVER: With the permission of the Chairman, I will recapitulate the chief points of the paper read the other afternoon, and also some of the questions that were asked by the gentlemen then present, in order that General Willoughby, who is here this afternoon, may be able to answer them. My paper consisted of a simple narrative of the operations in Madagascar from 1883 to 1885, which I may say was based almost entirely on a Blue Book which was drawn up by Major Cooke, of the Intelligence Department, and for which I now offer him my sincere acknowledgments. I had long been engaged myself in drawing up two large volumes,¹ but I found Major Cooke's abridgment was much more to the purpose

¹ Each volume contains over 560 closely-printed pages, besides numerous detailed maps. The mass of this material was placed by me at the disposal of the War Office. It represents information collected during the quarter of a century.

than my detailed and very voluminous papers, and therefore I made no scruple in making considerable use of Major Cooke's able *précis*. One point on which I laid special stress in my paper was this, that when the French made war their informants out there advised their Government at home badly as to the means and the ways which were needed to conquer Madagascar. M. Ferry's Government was very anxious to expand the French Colonies, and there were some ambitious Frenchmen in Madagascar who were only too glad to attract M. Ferry's schemes in that direction. But they must have badly informed him as to the numbers required, so that when poor Admiral Pierre was out there, I do not think he ever had a thousand men whom he could have landed apart from his ships' companies. Of course along the coast the French naval force was sufficient, but they never had more than a thousand effective¹ regular land forces (at all events at one locality). The consequence was, all dreams of passing up to Antananarivo were impossible. I have some maps (exhibited on the table) showing various routes. One, published with the paper, illustrates the road from Mojangà, which was the first place Admiral Pierre took, up to the capital, and although that is a tolerably easy country in spite of the length, it would have taken, according to the best English authorities—and the Duke of Wellington was one of these—the Duke of Wellington put down that from 10,000 to 14,000 would have been required to march on Antananarivo in the year 1845, and therefore it was impossible for the French to think of advancing up with less than 5,000 or 7,000 men. But, as I have said before, I do not think Admiral Pierre (or any succeeding Admiral) ever had a thousand men to put on shore apart from his ships. We all know that poor Admiral Pierre's health was declining; in fact, the climate killed him, and his successor, Admiral Galiber, was on most friendly terms with Captain Boyle, who was here at the last meeting. Admiral Galiber wrote and said he could not advance to the interior with less than at least 3,000 men; the following year it was 4,000 or 5,000 men, and as the Malagasy troops became organized under the superintendence of General Willoughby, the number of land forces required must needs be increased. That is the sole reason why the French never advanced beyond the coast. The Bishop of Mauritius, at the last meeting, thought that the Mauritius coal merchants would suffer by the mail steamers and men-of-war coaling at Diego Suarez instead of at Port Louis. He hoped also a field would be opened out for the emigration of Creoles from Mauritius and Réunion. I am sorry for the coal merchants of Mauritius, but I do not think the treaty will much affect them. I think the English trade at Madagascar, now that the country is opened, will do Mauritius a great deal of good. As for the field of emigration for Creoles, it is very curious that the Creoles could not be got to emigrate there before the war, but as I understand the present Government of Madagascar is willing to grant land to respectable emigrants upon the island, we must hope that a new era will set in. Admiral De Horsey and Captain Boyle both felt rather sore at British Sound being called Diego Suarez. The name Diego Suarez Bay does not occur on any older maps, although certainly during the 18th century it was applied simply to the two islets and the small indentation outside the very deep inlet which we at present call British Sound. Captain Owen, who surveyed that coast in 1824, was really the first discoverer of the deep inlet called by foreigners Diego Suarez. He first surveyed all its bays and he gave it the name of British Sound. The names English Bay, Irish Bay, Scotch Bay, Welsh Bay, were all very well for purposes of survey and of identification at the time, but now that the Malagasy have become an independent nation, I think the real native names will be resumed and should be resumed. I think the Geographical Society now prefer, instead of having such names as Smith, Brown, Jones, Robinson given to capes, inlets, and bays, that the native names should be ascertained as soon as possible and given to them; it is much more satisfactory to everybody. The Indian Survey name the peaks of mountains A1, A2, A3, and so on, till the native names can be properly ascertained, and very nice quarrelling they have

¹ The actual numbers shown on paper were more, but of these from 20 to 25 per cent. were non-effective invalids. At the end of the war, however, Admiral Miot had 2,500 land troops.

lately had over those native and other names.¹ Captain Boyle thought the English failed to comprehend that Diego Suarez commanded the trade on both sides of that island. Now, according to the treaty made between the French and the Malagasy, as far as I understand—I can only speak with great deference, because the gentleman who made the treaty and signed the treaty with Admiral Miot is present and will tell you what it was, and I am sure Admiral Miot is the last person in the world to repudiate a treaty which he has signed—I repeat, according to that treaty, full access is given along the isthmus to some capital harbours on the west coast of Madagascar just inside Cape Amber. According to Captain Wharton, one of them, which rejoices in the name of Port Robinson, is admirably adapted for steamers wishing to await the gales that blow round Cape Amber, lying on the leeward side. The entrance to Diego Suarez is on the windward side, and it is not, I am told, always easy to make out the entrance. It is a splendid harbour, and will shelter all the navies in the world if you once get them into it. No doubt one great advantage of the French holding that bay will be that they will beacon it and put a lighthouse there, and will erect some hotels, which visitors from Mauritius, Bourbon, and Réunion will go to as a watering-place. Captain Boyle also remarked that the climate is not so bad, as boats have been away for a fortnight at a time on the coast, but have not suffered from fever. But then they did not land there, and it is the fact, I believe, that his First Lieutenant who was away cruising did die of fever a few months afterwards. I find “Diego Suarez” marked on nearly all the European maps, except the English Admiralty charts. You may say “What’s in a name?” If we take possession of British Sound, well and good, let us call it British Sound; but as we have not got possession of it, I think the best thing will be to call it by the Malagasy name, which I believe is Antombôky.

The CHAIRMAN: “Diego Suarez” shows the original discoverer.

Captain OLIVER: The name “Diego Suarez” was given in memory of the great Portuguese navigator who discovered Cape Amber; but I do not think the first voyagers knew that there was a deep inlet inside, they only passed by the entrance. Admiral de Horsey was very anxious to know whether the French were going to exercise sovereignty over the reservation at Diego Suarez, or merely to erect coal depôts and sheds there. That, of course, it is impossible to say, but I dare say General Willoughby will be able to tell us, as far as diplomatic reticence will allow him, what the intentions of the French are. I think what I have said is a fair summary of the information asked for by the different speakers at the last meeting, and I myself have some questions to ask General Willoughby. I am sure the audience generally will be glad to learn from him information on the following points, so far as he can give it to us. The first is as to the numbers, state, and armament of the Malagasy forces when he took up his appointment there as Adjutant-General, in 1883. Next, if he will tell us how he set to work to put the raw material into shape, and to organize the inchoate mass of untrained men. Thirdly, how he managed to overcome the inveterate obstruction and obstinate prejudices of a peculiarly difficult race. I believe he got over this by insisting on absolute authority. Fourthly, we should like to hear the results of his organization, as exemplified by Colonel Shervinton’s expedition. Colonel Shervinton was an English Officer, a very gallant young man,² who conducted that expedition up to the north-west. I hope General Willoughby will be able to give us some details about his expedition. Next about the blockade of Mojangà, which after the French took, they never seem to have been able to pass beyond; in fact they were continually attacked there, as far as we can make out from the small amount of information that has reached this country. And lastly, as to the complete repulse of the French, who were driven back on their lines to Tamatave, in September, 1885, just before peace was made. A more delicate inquiry, on which we cannot expect any decisive answer, is the future of Diego Suarez, the actual position of the French with regard to that bay, and the intentions of the Hovas regarding availing themselves of the access across the isthmus

¹ Notably the late discussions about Mount Everest.

² Colonel C. R. St. Leger Shervinton was Military Secretary to General Willoughby, and formerly Adjutant to the Cape Mounted Riflemen.

to the harbours on the west side. There is another very interesting point which interests us more than almost anything else, although not peculiarly Madagascar. We have a little island called Mauritius, some 400 or 500 miles east of Madagascar, which is totally dependent on that country for supplies. That island, in obtaining which we spent a great deal of blood and money, is dependent upon the "Messageries Maritimes" for its communication with England, but the "Castle" mail packets have, I believe, often at a loss to themselves, kept up a communication between that island, Madagascar, and the Cape, which has enabled a great deal of independence to be preserved by our Colony, otherwise wholly dependent on the French for its communication. Had Madagascar been conquered by the French, Mauritius would have been entirely cut off, but as Madagascar remains an independent country, we now have an access to Africa, and I hope also that a telegraph line may be established, which need not be dependent on the French flag in any way, especially since quite lately the French have obtained a protectorate (as it was quite within their rights to do) over the Comoro Islands; therefore from the north of Madagascar to Zanzibar is, you may say, French territory to a certain extent. But by Madagascar being, as I hope, under a certain amount, even yet, of English influence, certainly independent lines of telegraph through Madagascar and across to Mozambique may be of the greatest importance to Mauritius, and keep our Colony, our fine harbour there, and our fortified position, the key of the Indian Ocean, in independent communication with the mother country.

Colonel BAYLIS: I would venture to make a few remarks with regard to the treaty. I have only had it in my hands a short time, but it is so plain in itself that I may safely put my construction upon it, and inasmuch as some questions were asked at the last meeting as to the effect of this document, to what extent it gave the right of interference of France, I think my remarks may be pertinent to the lecture. This treaty, dated 17th October, 1885, provides for placing the French representative in the position of a medium between Madagascar and foreign countries. By Article 1 it is provided that the French Republic will represent Madagascar in all its foreign relations, and the Malagasy abroad are to be placed under the protection of France. I understand that the French are merely to be the medium of communication. I think we must concede that that is so. Article 3 is very clear to show that this is limited to the French as merely the medium between the foreign Powers and Madagascar. It enacts that the President, representing the Government, will preside over the foreign relations of Madagascar, without interfering in the internal administration of the dominion of Her Majesty the Queen. And I have no doubt, whoever acted for Madagascar, carefully and advisedly put in those words, as showing that there was to be no interference whatever in the internal administration of the country. Article 9, I think, also gives a meaning to the treaty, for it says that until payment in full of the above sum of 10,000,000 francs, the French shall occupy Tamatave. Now if it had been intended that she should occupy any other place at any other time, it would have been so expressed. Therefore it is clear that, upon payment of this money, they were to withdraw from Tamatave, and they were not to occupy any other place except Diego Suarez, mentioned in Article 15. Then Article 11 is one which I call a defensive article. The Government of the Republic undertakes to lend assistance to the Queen of Madagascar for the defence of her dominions. Now if the language had not been very guarded, that might give a power of interference, but I do not think that this article does, without a request made by the Malagasy Government. It does not say that they are to interfere, but it says to "lend assistance." One knows very well that we do not lend people things unless they come to us for them, and I think it must be very clear indeed that before the French interfere they must be asked to give assistance. I admire the way in which the treaty is drawn; it is most guardedly drawn. Then we go on a little further to Article 15, on which some little doubt might arise, and by which the Government of the Republic reserves to itself the right of occupying the bay of Diego Suarez, and of creating these "establishments at its convenience." Now what does that mean? I think a question arose as to what the French might do there under that article, but having examined the treaty, I think it is manifest that this article was not intended for any other purpose than that they should occupy Diego Suarez for mercantile pur-

poses, and not for the purpose of interfering in any way with matters of government. I admit that that article would under ordinary circumstances, if it stood alone, let the French in, generally to occupy for any purpose, but the other parts of the treaty are so clear and distinct that it cannot be held to mean anything further than that they are at their own convenience to occupy it, and taking it upon the whole I think that it cannot be intended that they should do it for any other but peace purposes, and certainly not to interfere in the internal arrangements of the kingdom. I arrive at my construction of the document from my own reading of the document as contained within its four corners, but as some question might arise hereafter, it might perhaps be extremely useful, if General Willoughby felt at liberty, to explain what is the meaning and intention of that article, because at some future day, if it should be called in question, his interpretation of it would have great value.

Bishop RYAN:¹ I see that in the treaty the Queen is spoken of as the Queen of the Hovas, and not as the Queen of Madagascar. Her position in that respect seems to have been put a little on one side, and I should like to have some information on that point.

General WILLOUGHBY: Mr. Chairman, ladies, and gentlemen, I feel very flattered in being asked to address so distinguished an audience, especially as I feel certain that many who have come here to-day have given up some other very important engagements for the purpose. Bishop Ryan says that the Queen is only mentioned in the treaty as the Queen of the Hovas. That is a mistake, because if you look to Article 11 or 12 you will see that she is spoken of as the Queen of the whole island, which is one great point in the treaty. I will not give you a geographical description of Madagascar, because I feel certain that everybody present knows exactly its longitude and latitude, although that is a point upon which in some instances people are even now rather hazy. I was introduced to a gentleman by a friend, who in a stage whisper mentioned that I had come from Madagascar. He received me cordially, and after we left my friend told me that he turned round to him and said, "Can you tell me where Madagascar is?" I can only say that I wish it to be clearly understood, that when I left England to join the service of Her Majesty the Queen and His Excellency the Prime Minister, I had no intention of fighting the French. My appointment was given long before war was declared, and when I arrived in Madagascar and these operations had commenced, I thought I could not very well resign my appointment, and I therefore determined to see them through it. On the 15th of November I arrived at a place called Mahanoro, which had just been bombarded by two French ships, but owing to most of the shells being blind, the damage done was not very great. I went up to the capital as quickly as possible. I unfortunately was not able to get the number of men I required, and having only ten bearers, it took me nine days. When I arrived at the capital, my appointment had to be confirmed by his Excellency the Prime Minister. I found on arriving at the capital that there was plenty of raw material, and that the people were determined to resist the French demands to the utmost. It being impossible to organize at once the force at my disposal, the only thing that I could do was to drill them as best I could in small detachments, and send them down to the front. I am asked how I obtained the confidence of the natives of Madagascar, and especially of Her Majesty the Queen and His Excellency the Prime Minister? I can only say from first to last that Her Majesty and His Excellency have been my firm and staunch friends, although I have the pleasure of stating that I think that at the present moment I am the most disliked person in Madagascar, simply because I have tried to do my duty. One instance of this arose after I had the honour of bidding Her Majesty good-bye. I was going down to the camp, for after I left a sort of jealous feeling broke out amongst the Malagasy, who did not understand the difference between Vazaha and Vazaha (Europeans). The moment I got down to the camp rumours became rife that I was going to play the Malagasy false. The Queen, on hearing of this, turned round and said to her courtiers that I was really a friend of hers, and that

¹ Formerly Bishop of Mauritius.

anybody who spoke a word against me spoke it against herself. Of course when news of this reached the camp it to a certain extent helped my position, but still even at the camp I had a great many difficulties, as you may understand. The Malagasy are really very reticent in all private matters, and especially with regard to fortifications, and there was very great difficulty in my being allowed to see all the camp. There were little places which they thought I would not spot at the moment, which they really tried to hide from me. To give another instance, whilst reconnoitring I saw a place which I thought if an attack was made would be very convenient for a pontoon, for bridges, and also for artillery, and I pointed out that if the French placed their guns in a certain position, they would be able to silence our fire. This did not quite meet with the approval of the Malagasy, and they objected. I held a council of war and said, "You see I come down now as a friend of Her Majesty the Queen and of His Excellency the Prime Minister, and I can only tell you I must not treat you as children; I am simply here as a military adviser. If you do not like to accept my advice, the only thing I ask is this—that if the French attack there and you meet with disastrous circumstances, you will give me a letter that I can show to the Queen and to the Prime Minister, in order to prove that my advice has not been taken." After this there were some small reconnaissances, and I think some exaggerated reports got up to the capital that I had exposed myself a little to the enemy's fire. Public feeling then immediately turned, the Malagasy looked upon me as their defender, and I obtained to a certain extent the whole of their confidence. After being about three months in the camp, I went up to the capital; I then found that troops were being sent out to Tonquin. At that moment I had one or two offers of service from different comrades and also from friends. The services I accepted were from Colonel Shervinton, who then came to me as Major Shervinton. I can only speak of this Officer as one that served me most loyally and faithfully, and has done extremely good work in the Malagasy service. Also I must speak in high terms of praise of my other Officers, viz., Major Graves and Captain Sisson. As soon as Colonel Shervinton arrived, I formed a camp of 20,000 men at Antananarivo. This again would, I might say, have been a troublesome job if it had not been for the support we received from the Queen and Prime Minister. Nobody, except those who have seen Eastern countries, will know the staunch way in which the people will hold to their own ideas, and one of the ideas of Madagascar is, that they have what they call musical honours: that is to say, the 15-honour man, the highest, has 15-honour music, the 14-honour man 14-honour music, and so on. Now, when I formed my camp I asked the Prime Minister to abolish musical honours, because I found that whenever a 15-honour came on to the parade-ground, no matter what the regiment was doing, the moment musical honours began to tattoo, words of command were stopped, and everybody saluted the 15-honour music. This would never do, and I wrote to the Prime Minister and asked him to stop all musical honours, which he did. The men there were drilled for six weeks. It was really a camp of exercise; they went through regimental drill of all sorts, signalling, telegraphing, and really were preparing for an expedition to the north. The expedition to the north was composed of a column of 1,000 men, which was under the command of Colonel Shervinton, although the immediate command was given to a Malagasy. The object of that column was simply to strike a blow at the Sakalavas. The Sakalavas we considered as rebels, and orders were given that they should be punished to the utmost. Colonel Shervinton, when he got up as far as Jangoa, burnt Jangoa, and was going on towards Ampasindava Bay, when he was attacked by a lot of Sakalavas with their allies, the French. Of that battle and of that fight I will leave you to read the account of Admiral Miot, and also the account given in the English papers and in the papers furnished by Major Cooke. After that I also accepted the offices of a gentleman called Captain Graves, now Major Graves, who did excellent service in drilling the men in gunnery. He too came from the Colonial forces, and both of them before they came to me had been offered appointments, either by Sir Charles Warren or Colonel Carrington, to join the expedition to Bechuanaland. I can only say that both these Officers, by their courtesy to the natives and by the way that they performed their duties, have endeared themselves in every respect to the Malagasy nation, who have really a very high opinion

of them. After the Battle of the Sàhamàfy, I regret to say I fell short of ammunition, and I had only at that moment 100 rounds per man. This induced me at once to attack Tamatave for a strategical reason, because I was afraid that Admiral Miot, finding that my fire was slackening, would make another attack and compel me to retire from the camp. I therefore attacked Tamatave really in hopes of making him believe that I had abundance of ammunition, on the ground that no man in his senses, unless he had ample ammunition, would attack a place which otherwise he could not hold a single day. After this there were some private overtures to the effect that France would be willing should the Malagasy treat with them. When I came up to the capital the Prime Minister asked me if I would go to treat with Admiral Miot. I told him at the time I did not think Admiral Miot had the power at the moment to receive me, but I had no doubt he would telegraph the contents of the letter which the Prime Minister wrote to him to his Government in France. The French Republic replied that they would send out M. Patrimonio to meet me, and I went down to Tamatave. When I arrived there, I can only say that I was treated as only a French gentleman can treat another, with the most perfect courtesy. The moment I arrived at Tamatave I was accorded all honours, and we commenced to treat. I can only say from the conversations I had with Admiral Miot, I am certain if Admiral Miot had been there three years ago, there would have been no war at all—that everything would have been settled most comfortably, and really most peacefully. I must also state that there was a great deal of unpleasantness about Admiral Pierre, but I have talked to many gentlemen who had found him the most courteous of men. When he was at Tamatave, I know that he wrote a letter saying that he was ill, that he was dying, that he could neither see the land nor a chart, and he was badly advised. I am sure that when in health there was no one more courteous than Admiral Pierre. Admiral Galiber relieved him, and I believe if it had not been for the instruction that he had received from his Government, very likely everything would have been settled. After Admiral Galiber came Admiral Miot, who I have no doubt received instructions to make peace on the best terms he could, and I can assure you that Admiral Miot did the best he could, and that our relations personally were all that I could wish or desire. With regard to the treaty, I can only say I would refer Colonel Baylis to the appendix, which was also signed by Admiral Miot and M. Patrimonio. In that the powers of the Resident are clearly defined, and the land at Diego Suarez is limited to $1\frac{1}{2}$ miles to the south and east and 4 miles to the north of the extreme point of the bay towards Cape Amber. With regard to Article 11, you will find in the appendix that assistance will be given by France to the Hovas only if "it is demanded." With regard to Diego Suarez Bay, the French have not told me what they are going to do, but I can only tell you what was understood in a friendly spirit when we talked the matter over, that is, that they wanted it simply for a naval coaling station—for this reason, that during the war with China, Hong Kong being neutral, they had only one harbour to go to, and they wanted a port so that in case of neutral Powers not supplying coal, they could have their own coal there, and it is no doubt a very fine harbour. Réunion is very difficult of access; there is always a surf there, but here there is a natural harbour, in which they could store and whenever they choose. With regard to the operations there, I think that till Admiral Miot came, although there is no doubt the French had not sufficient power, instead of trying to take Sàhamàfy, which was naturally very strong, they ought to have attacked my flank at Ivòndrona. From Tamatave to this place the road is very easy, and there would be no difficulty in carrying guns on mules; and if they had built a fort at Ivòndrona, they could have covered the advance, and if they had taken Masoa, they would have either compelled me to attack them in their entrenchments, or they could have cut off the Army of the East, and I should have had to retire into the interior. Admiral Miot saw that and commenced it. I can only again acknowledge the courtesy I received when I was at Tamatave, and from the friends I have in France. I trust the treaty now made will be one that will be long continued, and that there will be the most friendly relations between France and Madagascar. I am certain France will find in me a warm friend if she will only carry out the treaty on her part with good faith. I am assured the

Madagascar Malagasy will strictly adhere to the letter and intention of the document. There is one other subject I wish to speak upon. Before I came away Her Majesty was good enough to make me Commissioner of Crown Lands. There is a lot of land in Madagascar, which is three times as large as the United Kingdom, but any stranger going there for the first time would find a little difficulty in getting land, because you want two persons to agree to it, and there might be some difficulties perhaps with the Governor. Now if any one who has about 400*l.* or 500*l.* would be willing to settle there and would give me names, I would submit them to the Prime Minister and would have a certain amount of ground surveyed, so that those who wanted to go out might have an opportunity of entering on their ground at once. Madagascar is so large that there is ample room for everybody. It is a very rich country. The exports are wax, sugar, and rice. I believe there is a great deal to be done in manilla, and certainly a good deal in sugar. Labour is cheap there, and I feel certain that Madagascar will produce sugar much cheaper than Mauritius at this present moment. Manilla will not pay under three years. Tobacco, I think, will pay. I shall be very glad to see any one upon this subject, and if I can represent them in any way, you may be perfectly sure I shall only be too pleased to put my services at their disposal.

Major COOKE: I should like to ask General Willoughby one question: is it not a fact that France, since that appendix to the treaty was concluded, has disavowed the appendix? The appendix was certainly concluded with M. Patrimoine by the Malagasy Plenipotentiary, but did not France at once officially disavow it? This question interests England principally in its political aspect. I am not at all certain that the appendix holds good now, for I have seen it publicly stated that France has declined to be bound by it.

General WILLOUGHBY: The only information that I can give on that subject is what I have seen myself in Major Cooke's papers. This is a political question, and if you will allow me I will not enter into it.

The CHAIRMAN: What is the general opinion of the raw material of the Malagasy as regards the making of a soldier?

General WILLOUGHBY: He is an exceedingly good soldier at the present moment behind earthworks. As you know very well, it takes six years to make a soldier, and after they have been properly drilled, I really should not be afraid to lead them anywhere. They have extraordinary personal pluck, and they will never disobey an order.

The CHAIRMAN: Ladies and gentlemen, it now only remains for me to thank the General for his courtesy in coming here to-day, and for the excellent way in which he has answered all the questions that have been put to him. While I was in Madagascar I formed a very high ideal of the Malagasy. They are a people with a great deal of education; schools are everywhere. They possess the most beautiful language that was ever spoken. Italian is nothing to it. The smoothness of the language is something remarkable, which is a strange thing with, as we thought, an utterly unpolished nation. The higher classes are deeply read. They have libraries that might grace the Prime Minister's library in England. They have books to which they can refer for every single thing, and they read every word of them, and know them. As to the Prime Minister himself, I say, without fear of contradiction, he is the cleverest man I ever met. I have had long conversations with him, and on every single point, especially on political points, I never knew a man who so clearly and thoroughly understood everything as the Prime Minister. He was quite extraordinary in his grasp of intellect, and in his thorough knowledge of what his people could do, how much he could teach them, and where to stop. If everything is allowed to go on in Madagascar as it went on in those days, I am sure, under the auspices of the Queen and her Prime Minister, there is a great future for Madagascar. I am sure you will allow me to thank General Willoughby, in your name, for his courtesy to-day.

Colonel BAYLIS: I shall be very glad to second that, and in doing so I may say that although this island is so near Africa, its language comes from the stock or the root of the Malayo-Polynesian language.

BARNETT'S PATENT WATER-BRAKES.¹

By Mr. FREDERIC BARNETT, C.E.

By the kind permission of the Council I am permitted to introduce to your notice this model, with the object of bringing into evidence the principle of my *water-brakes*; I shall intrude on your patience but for a limited time.

I beg to submit that if my system were applied to ships that go down *to* the sea, many less would go down *in* the sea, by avoiding collisions, and thus prove the means of saving many thousands of valuable lives and untold treasure.

Is it too much to hope, if such means can be applied to ships to diminish in a great measure the appalling casualties which are the outcomes of collisions at sea—though not guaranteeing perfect immunity—but lessening in an important measure the numbers of ships that yearly collide with other ships, with floating ice, with submerged rocks and shoaling water, by neutralizing the way on vessels, or by almost turning a ship in her own length either to her port or star-board, that the comparatively trifling cost of fitting such apparatus as these *water-brakes* will not be grudged either while the ships are building or to those already built?

I have reason to believe that should this principle be applied, owners will find ample compensation in reduced rates for underwriting, and in increased profits from additional patronage, especially in passenger ships.

As regards the Royal Navy few words need be said, as it must be self-evident that in warlike evolutions, the facility for rapidly checking speed, and the improved power of turning to the right or to the left in the emergencies of a naval engagement, must prove highly important.

On this subject a paper was read during the last sessional meeting of the members of the Institution of Naval Architects, by Captain Colomb, R.N., the Earl of Ravensworth presiding.

The paper was entitled "*Recent Measurements of Turning Powers of Screw Ships.*" The author observed—

"That increasing attention had of late years been given to the accurate measurement of manœuvring power of steam ships, and more especially to that part of them which embraced the turn of screw steamers when at speed to the right or left of their original path under the action of the helm. The investigation of the nature of the turn might be said to have begun a quarter of a century ago,

¹ Read at the meeting held on 12th July, 1886.

when the increasing length of the war ships made us familiar with two facts, that *considerable space* relatively to the length of the ships and *considerable time* relatively to their normal speed, must be occupied before the ship could make any considerable change in the direction of her path."

Without trespassing too much on your time and patience, I will briefly quote a further portion from Captain Colomb's interesting paper:—

"That the subject has been held to be so important in maritime warfare that for many years experiments have taken place in England, France, and Russia, and that many distinguished names are connected with them in England, some of the earliest were carried out by Admiral Sir Cooper Key; in France and Russia the names of Admiral Bourgois and Admiral Gregory Boutakov; that in France the knowledge had been greatly advanced by MM. Risboeq, Disclere, and Lewal; while in England Sir N. Barnaby, Mr. Barnes, and Mr. Philip Watts, all of the Admiralty, had assisted to clear up many doubtful points."

The above quotations from gentlemen of the profession go far to sustain the argument of the very great importance of any easy and simple means of turning a ship of war, during an engagement or otherwise, rapidly to the left or right. Such means, I submit, will be obtained by the immediate action of these water-brakes, when either one row or the section of a row is brought instantaneously into play; because the momentum of the ship on the one side being paralyzed, while that on the opposite remains unchecked, the vessel will almost turn in her own length, and while there is any way on her, her action will be short, sharp, and effective.

I am also of opinion that when the brakes are applied to the sides of any vessel, in due size and number, the ship will, when required, be brought to a speedy standstill by bringing them *on both sides* into action simultaneously; this operation being easily effected by suffering them to plunge into the water by their own gravity on releasing the chains on which they are suspended. No other apparatus than a few block pulleys and chains are required, hence there is nothing to get out of gear.

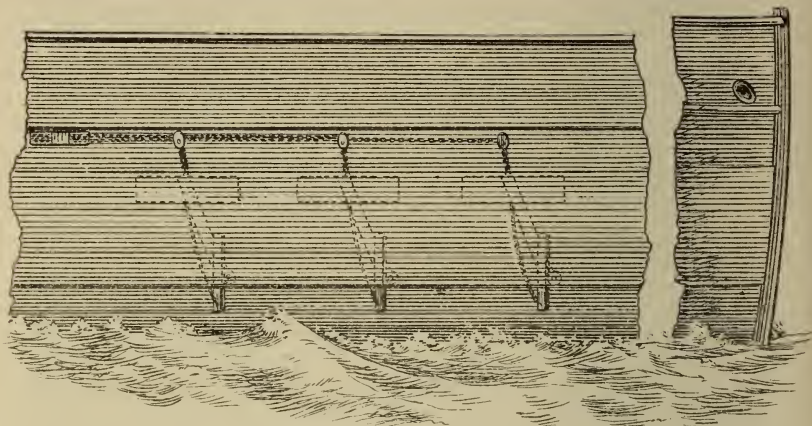
The brakes, according to the duty required of them, may be constructed of iron, steel, or other suitable material, of such substance and strength as will enable them to resist the strain to which, when in action, they would be liable. Their form, for choice, will be an elongated square, from about 2 feet by 1 foot to 10 feet by 5 feet, more or less according to the tonnage and speed of the craft, and their relative position will be to the ship's side that the greater length will be nearly vertical. The blades will work on suitable hinges, as shown in the accompanying plate, firmly attached to a strong metallic arm, the end of which will work on a pivot attached to the ship's side, strengthened in the interior of the bulwarks, where also will be a small drum or winch, on which will coil the chain employed to raise the brakes from action in the water. These in small vessels will be worked by manual labour, and in large vessels, be hitched on to the steam or other suitable power.

When not in action, the brakes will be snugly triced up by their supporting chains into and under a sort of belt, which, while keeping them safe from contact with other ships at close quarters, will also

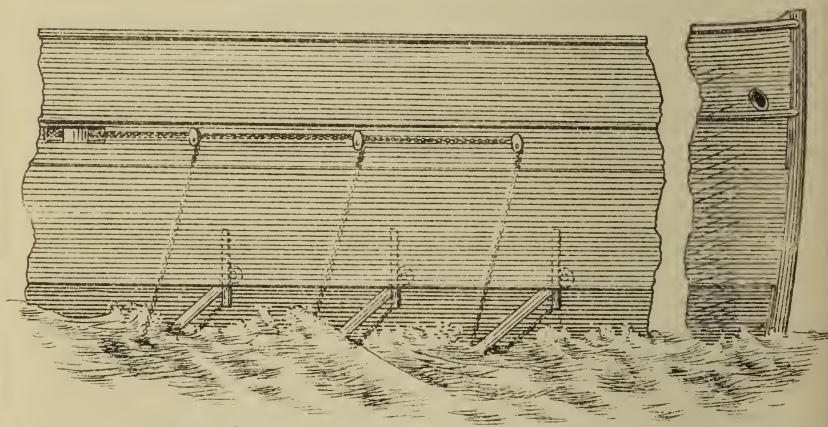
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IMPROVED WATER BRAKES.

TO CHECK THE SPEED OF SHIPS, LIKEWISE TO ASSIST
IN STEERING THEM.



OUT OF ACTION.



A _ IN ACTION

secure them from friction when entering harbours or docks, &c.; at the same time, being clear above the water-line, there is no friction with that element.

I should also wish to affirm my conviction, collected from eminent gentlemen of the Royal Navy, that for various evolutions in naval warfare, such as ramming and torpedo practice, the water-brakes will prove of valuable importance.

By the courtesy of the Secretary of the Registrar-General of Shipping and Seamen, I find that the loss in one year of ships at sea, British and Colonial *only* (no foreign or Government ship being included) was 964. This period was from the month of June, 1885, to that of May of the present year, both inclusive. It is quite probable that many (if not all) of these vessels, with their human and mercantile freights, might have been saved, if their commanders had had the power on emergencies of checking speed, or of bringing their vessels to a stop or turning their heads by means of the rapid action of these water-brakes.

My brakes, I believe, are destined to other important applications. Independently of the use above enumerated I may mention that two similar brakes, fitted independently of the others, on either quarter, will in case of accident to the rudder or steering-gear, prove of inestimable value, as the vessel could at once be effectually steered by them, without loss of time; the same, if for the Navy, would serve as auxiliary and fighting rudders.

I am also *hopeful* that by suffering the brakes to descend somewhat lower into the water, till they become nearly in a horizontal position, they will materially assist in counteracting the rolling motion of the ship without other cost than the slight lengthening of the sustaining chains.

APPENDIX.

Extract of a Letter.

Broadway Chambers,
Westminster, S.W.

DEAR SIR,

Having examined the working model of your water-brakes, as to the merits of your plan there can be no doubt that as a means of bringing a ship to a speedy standstill your arrangement, properly worked, would be efficient.

Dear Sir,

Yours very truly,
(Signed) E. J. REED.

F. Barnett, Esq.,
106, Queen Victoria Street, E.C.

1136 COLONEL MULOCK'S PATENT FOR DRIVING PUNKAHS.

10, Wilton Place,
Belgrave Square, London,
September 23, 1886.

DEAR SIR,

I have seen your water-brakes, which I consider both original and effective.

Yours truly,

F. B. HEATHORNE,
Captain.

Frederic Barnett, Esq.,
106, Queen Victoria Street,
London, S.E.

COLONEL MULOCK'S PATENT FOR DRIVING PUNKAHS.

(Read by Colonel T. EDMONDS MULOCK, C.B., at the Meeting on
14th July, 1886).

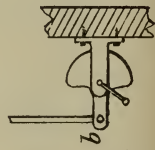
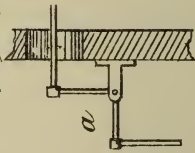
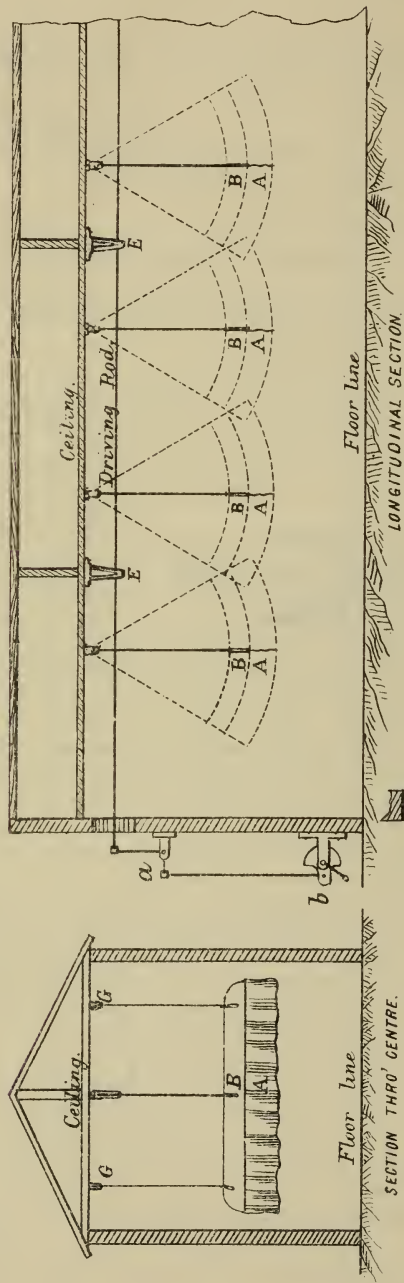
THIS is an invention for driving punkahs by means of a wheel attached by brackets to the outside wall of a building. A crank is fixed by brackets at the required height, and is set in motion by the wheel below by means of a perpendicular rod. A horizontal driving rod passing through an aperture in the wall is pivoted on the arm of the crank.

The punkah is hung by three rods from a beam in the roof of the apartment, and is acted on by the centre rod pivoted in a slot or jaws in the horizontal driving rod, which is propelled backwards and forwards by the action of the crank. This horizontal rod being elongated and run through supports, can be made to drive several punkahs. Punkahs in adjoining apartments can also be acted on by a shafting from the pivot of the centre crank being attached to similar machinery for the rooms on either side. According to the present mode of punkah-pulling the air is only disturbed on one side of the punkah, which merely swings back from its own weight a few degrees beyond the perpendicular, whereas by this invention the entire apartment will be ventilated.

The model before you is on the scale of 1 inch to the foot, and a room 30 feet by 20 feet is shown as worked by hand as if it were a room in a bungalow. I calculate that one coolie would be able to work three large punkahs either in line or abreast, so that even in private houses there would be a considerable saving in labour with double the amount of air-disturbance. But this invention is peculiarly adapted for ventilation of hospitals, barracks, and other public buildings. Up to the present I have been unable to ascertain what sum is paid yearly by the Indian Government for punkah-pullers. I am, therefore, obliged to make a rough calculation founded on the experience of civil and military Officers who have served in India. Let us take a barrack-room for 80 men, *i.e.*, 40 beds on either side: give 4 feet for each bed, or $2\frac{1}{2}$ the bed itself and a space of $1\frac{1}{2}$ feet between; such a ward or barrack would be 160 feet long. Then *five* punkahs hanging as shown in the model, would serve to ventilate the whole.

The motive power for working this invention can be supplied

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Section of support:

A. Fringe B. Frame.

G. G. Light rod to steady swing.



Jaw in which centre rod works.

Section of pivots, driving rod & hook.

in several ways, either by a small engine or by horses or bullocks. I take it that bullocks would be found to be the cheapest mode of working in India where water-power is not easy to procure and coal is expensive. One bullock working (as in a threshing machine) would keep in motion the five punkahs for ventilating the above-mentioned ward 160 feet long for 80 men, that is to say, with a relay of two bullocks and two bullock drivers for eighty beds. According to the present system I believe I am correct in stating that it requires *two* punkahwallahs for every *ten* beds. Then, according to that computation, let us see what the Government would save by adopting this invention.

| | |
|--|-----|
| A ward or barrack for 80 men at present requires | Rs. |
| 16 coolies at Rs. 4 a month | =64 |
| Against which set 2 bullocks, Rs. 20, 2 drivers, | |
| Rs. 8..... | =28 |

—
Saving Rs. 36 a month.

In most stations punkahs are required for eight months in the year; but let us take it at six months only, then the saving for giving ventilation for 80 men for that period would be 216 rupees; but we have upwards of 50,000 European troops in India: knock off 5,000 in the hill stations, &c., and we have on 45,000 men a clear saving of 121,000 rupees a year.

I daresay many of us have experienced the extremely disagreeable sensation of awaking in the middle of the night bathed in perspiration, with the punkah hanging motionless above us, and the punkahwallah fast asleep outside, and this not once but perhaps three or four times during the night. From what I can learn from Officers who have lately returned from India the same thing still holds good. Everything else has gone on improving in a wonderful manner, yet still the sleepy punkahwallah sits and pulls away at the original supplejack through the time-honoured neck of the broken bottle. Is it not high time that there should be some change in all this, and that some advance should be made towards giving our countrymen in India a chance of a whole night's sleep, and also showing them how it is possible to have ventilation on all sides?

Now, with regard to the probable expense of putting up these fittings, let us take first one room in a private bungalow. It will be seen that the fittings, which are of brass in this model, may be, when full size, equally effective in hard wood and iron, and could be made in any bazaar in India.

| | Rs. |
|--|-----|
| Say 4 wooden brackets, with brass sockets | 5 |
| Wood in wheel and handle | 2 |
| 6 yards of $\frac{1}{2}$ -inch iron tubing for perpendicular driving rod | 2 |
| Iron crank..... | 2 |
| Horizontal driving rod of wood or $\frac{1}{2}$ -inch tubing | 3 |
| Casting or bazaar hand-made centre action | 2 |

Total..... Rs. 16

I am sure that would be a liberal allowance for one punkah, and it will be seen that by elongating the driving rod half-a-dozen other punkahs could be worked at a trifling addition to the expense. Taking it for granted that one coolie could work three punkahs for three separate rooms, let us see what the saving in labour would be.

| | Rs. |
|--|--------|
| Cost of putting up three punkahs at outside price for one (<i>i.e.</i> , Rs. 16) | 48 |
| Hire of 2 coolies for six months, at Rs. 5 a month.... | 60 |
| | <hr/> |
| Total | 108 |
| Contra—Hire of 6 coolies for six months, at Rs. 5 per month..... | 180 |
| | <hr/> |
| Saving first year | Rs. 72 |

But the saving for the ensuing years would be $72 + 48 = \text{Rs. } 120$, *i.e.*, the first cost of the machinery.

With regard to barracks, hospitals, and other large buildings recourse would be had to either steam, water, or horse-power. Any practical engineer could at once point out the best way of connecting and adjusting the wheels for driving the machinery. Indeed, I thought of having a model horse machine attached to this, but found that it would be almost as expensive to construct as a full-sized machine.

Native workmen are clever at putting up saw-mills. Persian wheels, &c., and iron castings for the required cog-wheels might be made in India. Eventually, perhaps, it might be found that these punkahs could be worked by compressed air, or by winding up a strong spring or a weight with an endless chain. Several years ago when I was in India the East India Company offered a large sum as a premium to any one who would invent a satisfactory punkah, but nothing satisfactory came of it.

I hope the explanation which I have endeavoured to make as clear as possible will have interested the members of this Institution. Doubtless there are members present who have been in India who are in a position to give an opinion as to whether this invention is calculated to suit the requirements for ventilation in tropical climates.

To take down Punkah.

Remove pivot of horizontal and perpendicular rods and unhook from beam.

Wednesday, December 8, 1886.

LIEUT.-GENERAL L. NICHOLSON, C.B., R.E., Inspector-General of Fortifications, in the Chair.

COAST DEFENCE.

By Colonel SCHAW, R.E., Deputy Director of Works for Fortifications.

LIVING as we do in an island, close to a great continent whose inhabitants, warlike and with standing armies immensely outnumbering ours and with navies of yearly increasing strength, may at any time become our enemies, the question of coast defence must always be one of great interest to Englishmen. But apart from the necessity for resisting an invasion of Great Britain by a foreign army, which, however much we may be inclined to blink the fact, is a very possible contingency under the one important condition that our fleet had in some way been disposed of, it is essential for the life of that fleet on which our national existence may truly be said to depend, that secure harbours and naval arsenals and dockyards should be provided for our Navy where ships can be built and fitted out, whence they can issue to attack an enemy, and wherein they can safely repair damages and obtain fresh coal, ammunition, and supplies of all sorts.

I can only lightly touch in this paper on the subject of invasion; that great question has quite lately been discussed in this theatre after important papers by Sir Charles Nugent, by Major Elsdale, and by Admiral Arthur; I would only remark, before passing to the other branch of the subject of coast defence, that in whatever way it can be best accomplished it is our clear duty as Englishmen to be prepared to resist strongly and effectively the landing of an enemy on our shores and his advance on London. It is urged by some that a volunteer naval organization will best effect this object, and that a hostile fleet endeavouring to land an army on English ground would be most effectively opposed by the active attack of numerous torpedo- and gun-boats forming the normal naval defence of every small harbour on the coast, and converging by prearranged signals on any threatened point; others would prefer to use a land organization and to attack an enemy when attempting to land by infantry and machine-guns and light artillery; others again, recognizing the very great advantage which must always rest with the attack, of choosing time and place, and of deceiving the defender by feints, enhanced as it

is by the power of rapid movement irrespective of wind and weather which steam confers on ships—would prefer to trust to a reserved defence, after an enemy had landed, and when he was committed to a definite base of operations and line of attack. In my own view all of these means of defence must be used, and should be thoroughly organized, but above and before all our fleet must be maintained and raised to the full strength and degree of efficiency for successful offence which is always the surest means of defence. But however strong our Navy may be, so extensive is our Empire that, as has frequently been demonstrated, an invasion of England is not a mere chimera evolved out of the inner consciousness of weak-minded panic-mongers, but it is a very real and present danger to us if we are unprepared to resist it, and I need not go over this ground again. It will be enough to say that we are *not* prepared, and that at the present moment, in the absence of our fleet, England is unquestionably quite open to invasion.

The primary need is the absolute superiority of our fleet, and that we should always be prepared to resist a landing by a suitable system of defence, including both the attack of the enemy on the water by local naval means which would also be the only possible way of preserving our sea-coast towns from bombardment, and also by movable land forces to oppose his landing. No Englishman can contemplate without indignation and dismay the idea of a foreign army established even for a short time in our country, and we should take all possible precautions to prevent such a thing from being ever accomplished. By an active coast defence we can undoubtedly make it exceedingly difficult, and this difficulty may be so great as probably to deter an enemy from attempting it; but all experience goes to show that a skilfully arranged attack in sufficient force may prove too strong for the comparatively weak defence which, from the nature of things, can only be secured at each point on our extensive coast line; and unless we have a home army sufficiently strong and well equipped and disciplined to crush the invader after he has landed, we may be conquered.

The order of precedence therefore is first a strong navy; second, a defence of our coast line, and more particularly of small harbours, which might serve as bases of operation for an invader; third, an army to meet the enemy in the field should he succeed in making good his landing. And here I would incidentally observe that in my judgment any large expenditure on permanent fortifications encircling London would be a waste of public money. What we do want, as has been forcibly and clearly explained by General Sir E. Hamley, in a lecture delivered in this theatre lately, is a sufficient body of well-trained and well-armed volunteers whose special object and duty is the defence of the metropolis; and that their annual training should include definite instructions as to the position each corps would occupy, and the works of demolition and construction they would have to execute in case of invasion. This is but a small extension and specializing of the organization of our volunteer army, an army of which the nation may well be proud, although much still

remains to be done to give it full value, and notably that each man should be able to shoot straight if even at short ranges only. But to shut up millions of people in this great city seems to me out of the question—to feed them in peace-time is little short of a miracle—but with an active enemy outside our gates, cutting the railways and roads by which supplies come in, a few days would end the matter, however strong our fortifications might be.

All that can be hoped for is that the General Officer commanding the army in the field should have no fear that an enemy landing, perhaps, in two or three separate places, could, with one part of his force, make a dash on London and seize it while the remainder engaged our army. I am quite aware that imperfectly trained troops defending extemporized entrenchments would be hardly pressed by thoroughly trained regular troops; yet I have sufficient confidence in my countrymen to believe that they would be able to hold their own for a sufficient time to save London, by giving time for the field army to arrive on the scene. But it is on our coast line that we want the greatest numbers, and as our old system of martello towers and similar works is now obsolete, a new organization for coast defence is a pressing need. It is a very large subject, and I will not attempt to deal with it now; it should be taken up and reported on by a joint Committee of naval and military Officers, with whom should be associated Officers of the volunteer army.

As regards our first requirement—a strong Navy—much has been said and written of late. I do not propose to discuss the question of its sufficiency for our necessities. That our personnel is the first in the world is an axiom, and although our guns are doubtless somewhat behind the times, we are now alive to our deficiencies and are making gallant efforts to pull up leeway. With a well assured naval superiority to any probable combination of the Great Powers we may be satisfied, but with less than this it is impossible for such a Power as England to be content.

It has been argued that this is our *only* need, and that as long as we maintain our naval supremacy, invasion is out of the question. We may admit this so far as to acknowledge that were our Navy destroyed there would be no need for invasion, for England could be quickly starved into submission—dependent as we are for our food supply on our imports—and for our national wealth on our commerce—naval supremacy is beyond all doubt a necessity for our national existence.

But even with a powerful Navy still in existence, were we engaged in a real struggle with a combination of Great Powers, who will say but that on the sudden outbreak of war, before we had made war preparations, or while our naval strength was fully occupied at a distance from England, a powerful army might not cross the Channel to attack us in our island home were we unprepared to resist it? I think it must be acknowledged that past history leads to the conclusion that such a contingency is by no means impossible, and that we live in a fool's paradise if we don't prepare for it. Certainly, even if an actual invasion in force were not attempted we should be

exposed to the great danger of the destruction of our naval arsenals and still more of our great commercial ports, those great sources of national wealth and strength, if they be left unprotected by sufficient defences in the absence of the fleet.

It is to this question of most pressing national importance that I would draw your attention, and in its consideration I would also include the protection of our coaling stations and of our military ports abroad, which are practically of as great importance to us as a nation as are our ports at home. England is no longer merely an island or a kingdom of two islands, but a great Empire stretching over the world; its various parts linked together by ties of commerce and kinship and mutual interest, and depending for its unity and strength on our command of the sea. This command of the sea requiring, as it always did, secure harbours for refuge, revictualling and refitting, needs now the further provision of ample supplies of coal at convenient depôts within steaming distance of one another. One of these depôts wrested from us and in an enemy's hands would cripple us greatly and cut off our connection in a great degree from some of the integral parts of the Empire. Hence it is that this question of coast defence as applied to harbours has assumed the very highest importance to the British Empire.

There are several ways in which a defended harbour may be attacked. If taken by surprise on the sudden outbreak of war, a small squadron might enter one of our great military ports and might inflict most serious injury before forces could be collected to meet such an attack; or possibly an enemy might declare his hostility after he had entered the port as an apparent friend and so turn all our defences; or in a more regular way, an enemy may content himself with bombarding a harbour from a distance, to destroy shipping taking refuge, and the stores and means for refitting or building ships in it; or he may enter the harbour with his ships after having first silenced and destroyed the defences. Or if only opposed by batteries defending a channel leading to the port he may risk running past them at speed if not prevented by mines or obstructions; or, finally, he may land men in the vicinity and so turn the sea defences and open the way for his ships.

These different modes of attack or any combination of them must therefore be guarded against; and in designing the defences of any particular port we must take into consideration the probable strength of the attack to which it may be subjected. In these islands, owing to our proximity to the Continent of Europe, the attacks to which we are liable are of the most serious nature, and our defences must be of a character suited to meet such attacks. The more important also the place to be defended the more likely is it that an enemy would be prepared to make considerable sacrifices to destroy or gain possession of it.

Our great military ports, like Portsmouth and Plymouth, must therefore be strengthened to the utmost, so as to be able to beat off a most formidable attack, as the loss of one of them would be a national disaster.

On the other hand, a great commercial port like Liverpool, however serious would be the national and private loss involved by its bombardment or destruction by an enemy, would not touch the life of our fleet and the national power in the same way as the capture of Portsmouth, and therefore it does not offer quite so great a prize to an enemy, who would be the less inclined to make great sacrifices in attacking it. The defences may therefore be of somewhat less strength.

In distant parts of our Empire, as in Singapore, for instance, where an enemy would be at a great distance from his naval base, and could therefore not refit or obtain fresh supplies of ammunition and coal with facility, his attacks would probably be of a less serious nature than those he would make on ports nearer his own base of operations.

The natural features of the ground, and configuration of the shore, and the existence of shoals or rocks, or strong tides with great rise and fall, or other peculiarities affecting navigation, all influence the system of defence to be adopted, and each particular case must be studied with reference to all such points before a wise decision can be arrived at as to the best disposition of the several elements which should be combined in due proportion to obtain a defence suited to the special circumstances of the place. But whatever be the means adopted, in these days of sudden outbreaks of war and of the general readiness of foreign Powers for rapid mobilization, it is vitally important that each defended port should be ready at very short notice to resist attack, having a complete organization and well defined chain of responsibility.

The principal element of defence against a naval attack must always be artillery—a war-ship is a floating battery, its power is mainly in its guns, the shells from which can produce great destructive effects at long ranges.

Bombardments are now possible at ranges of 8,000 to 10,000 yards distance, which would have seemed fabulous in former days, and although the actual destruction produced by a bombardment may be less than would be at first sight thought probable, yet, if ammunition be plentiful, it is undoubtedly very serious, and may be disastrous, if magazines be exploded or important storehouses set on fire.

Dockyards are perhaps less inflammable now than they were in former days, as iron enters so largely into the construction of our ships, yet a great quantity of wood and other materials that can be set on fire must be found in every dockyard, and in any case the bursting of large shells containing many pounds of powder or perhaps dynamite will work great havoc.

This artillery attack must in most cases be met mainly by artillery defence, and the selection of the proper number of guns of suitable calibre and power is generally the first consideration. The number of guns now employed in coast defences is very much reduced as compared with the number formerly considered necessary. Several causes have combined to bring about this change.

First, guns have increased so greatly in size, power, and cost that ships carry but few of them—120 guns was the armament of an old three-decker. The most powerful first class ironclads now carry from

4 to 10 or 12 heavy guns. The total weight of metal may not be far different, as the old smooth-bored guns, the heaviest of which weighed 95 cwt., have now been replaced by rifled guns of from 30 to 100 tons weight; but the rate of fire with these monster guns is, of course, much slower than with the smaller guns formerly used.

A modern ironclad is fairly invulnerable in all her vital parts to the projectiles of light artillery, and it is therefore necessary that the shore batteries should have at least a few guns capable of penetrating the armour of such ships as are likely to be brought to attack them. This is the first essential, and it must be borne in mind that the risk to the ship is always much greater than the risk to the batteries on shore. If a battery is struck its parapet may be injured, a few men may be killed or wounded, a gun may even be disabled by a lucky shot; but if the magazines are sufficiently protected no great disaster can occur, unless the attack so far overmasters the defence in number and weight of guns and accuracy of fire that the gunners are driven away, and the batteries are silenced, as happened at Alexandria; but if the contest be at all equal, each penetrating hit on a ship means not only terrible destruction in the confined space on board, but also perhaps injury to the engines or steering gear so as to render the ship unmanageable, or possibly so great a rent in her side between wind and water as to sink her outright, or so to disturb her equilibrium as to put her out of action. And beside all this, the gunners on shore have now at their command such accurate instruments for ascertaining ranges and directing their fire, that the percentage of hits from the guns on shore, with stable platforms and everything in their favour, ought always to be much greater than the percentage of hits from the guns on board ship, which in most cases are on unstable platforms, and have less accurate means of getting their ranges.

It is true that naval gunnery has made great strides, and that under favourable conditions ships may make very good practice, and further, that the gunner on shore, if he fails to lay his gun correctly on a ship moving rapidly, may have to lose much valuable time in training and laying again, while the ship can steer her course so as to bring her guns to bear when she pleases; but the system of position-finding is altering all this, and when it is fairly established will enable the guns on shore to make practice incalculably better than could have been made under the old system by the most skilful gunners. It follows, that upon the whole the old condition of things may still be considered to hold good, and that a few guns on shore well placed, well protected, and well served, will still be able to contend on even terms with a much larger number afloat.

But it will not do to content ourselves with a few armour-piercing guns only. Ships carry, in addition to their heavy guns, an armament of medium, quick-firing, and machine-guns, and if they can approach within 1,000 yards of shore batteries containing only a few heavy slow-firing guns, they may pour upon them such a storm of smaller projectiles as to make it impossible to serve the heavy guns, and this danger is greatest when the batteries are at a low level, and the guns

close together. This mode of attack must be met by a somewhat similar armament on shore in all cases where ships are not kept at a distance from the batteries by shoal water or other obstacles. In any case a number of lighter guns will be associated with the heavy guns to keep up the fire and to attack the unarmoured or thinly armoured parts of ships.

We arrive then at the general conclusion that the character of our artillery defence should be ordinarily a limited number of armour-piercing guns supplemented by a more numerous array of medium, quick-firing, and machine-guns.

But there is another class of artillery fire which is doubtless destined to take a very prominent place in coast defence in future, and which probably may also be used on board ship with good effect in calm water. Ever since the days of Coehorn high-angle fire to attack an enemy from above instead of in front or in flank has been used more or less; but with the old S.B. mortar such fire was so very wild and uncertain that it had fallen somewhat into disrepute. Rifled howitzers have now, however, restored to high-angle fire its full comparative value, and foreign nations have for some time past accepted the heavy howitzer as an important weapon for coast defence. It is evident that a heavy shell falling on the deck of an ironclad turns the flank of its armoured defences, and if it has power to penetrate the lower steel deck it may destroy the engines, blow up the magazines, and even sink the ship by knocking a hole through the bottom. It is, however, a well-known fact in ballistics that high-angle fire and high velocity are well-nigh incompatible, and as penetration varies as the square of the velocity, the penetrating power of howitzer shells fired at high angles and with comparatively low velocity is small.

On the other hand, the flotation power of ships has its limits, and if the sides be made safe against direct fire by thick armour, the decks cannot be protected by heavy armour also. The practical limit for deck defence seems to be 3 or 4 inches of steel, and this is probably penetrable by 9-in. or 10-in. shells. Experiments to determine this point are now being made, and we shall then be able to determine the necessary calibre of the howitzers to be employed for this purpose. If then we can succeed in hitting ironclads at long range by heavy shells falling on their decks at a high angle, we shall have enormously increased the relative power of shore batteries. For whether the steel deck at the water-line be penetrated by the heavy shells or not, the shells will certainly penetrate the upper decks, and will burst in the ship amongst the men and guns, and the effect of such explosions will be so very destructive that we may fairly calculate on making ships move off when they find themselves subjected to this form of attack.

Recent experiments have shown that the chances of hitting a fixed target by this means when the range is accurately determined are very good, and it follows that no ships could anchor under the long-range high-angle fire of heavy howitzers.

The chances of hitting a *moving* object by fire of this character are

no doubt very much less. The time of flight of the howitzer shell for a long range is so great that it is very difficult to judge correctly the direction in which to fire. The rate of motion of the ship, the time of flight, the action of wind, and many other disturbing influences all combine to render high-angle fire at moving objects uncertain. On the other hand, long-range fire from ships is most inaccurate unless they are at anchor, or unless they circle, firing when they reach a buoy or other fixed mark at a known range from their target. If they anchor they can be hit, and the fixed point at which they deliver their fire, if in motion, is also a target for the howitzers on shore, which will materially aid their practice.

As against bombardment then, howitzers will doubtless play a prominent part, and happily for us it has been found that our old muzzle-loading rifled 9-inch guns, and probably those of higher calibres, can be readily and cheaply adapted for this kind of fire; combined with them must be a few long-range B.L. guns to make our fire thoroughly effective; but there can be little doubt that few naval commanders would risk the destruction or serious damaging of their ships by this howitzer fire to obtain the somewhat problematical results hoped for by the long-range bombardment of a dockyard or harbour; in most cases an attacking fleet would prefer to come to closer quarters, and either run past the batteries, or silence them at moderate ranges.

The experience of the last American War showed that ships could generally run past shore batteries at speed without suffering much damage, and if the prize to be gained be sufficient such tactics would doubtless be tried again were no means taken to prevent it. The obstacle which most thoroughly meets this need is the submarine mine. There is something so horrible in the idea of being suddenly blown up without the slightest power to resist or retaliate, that mines whether under ground or under water have always, since their first introduction, had a most deterrent effect on attacks. The knowledge that certain waters are mined is certain to keep away from them any but the most determined or foolhardy Captains, and it may be safely assumed that no modern fleet would risk the terrible danger of running through a channel defended by submarine mines, until those mines had been in some way rendered harmless. The addition of submarine mines to our coast defence system has thus enabled us to dispense with many guns which would otherwise have been necessary, and to obtain a more efficient defence at a less cost. The lessons of the late combined operations at Milford Haven have been variously read, some warm naval advocates having assumed that the defence by submarine mines had proved ineffective, and that the naval attack had an easy victory—others having taken a very opposite view. Having been officially connected with the operations, I may be allowed to express some opinion upon the real state of the case. And first I must say that the primary condition under which the operations were undertaken was that it was *not* to be a trial of strength and skill as between Navy and Army—but rather a field-day from the careful observation and criticism of the events of which lessons might be deduced to

assist us in improving our defence system. It was assumed that the naval attack would be strong, that it would be directed with skill and energy, and that the constant practice of the fleet would show to great advantage in the perfection with which they would carry out their programme.

And these assumptions were fully justified by the action of the fleet. The attack was most ably designed and directed, and was executed with admirable precision and skill, but unreality in both attack and defence is inevitable in all such peace manœuvres. Some of the elements of unreality which favoured the defence were the following:—

1. The defended channel, both from motives of economy and also for convenience of traffic, was only a portion of the whole channel. This limited the range of choice for the assailants, and brought them closer to existing forts than might have been otherwise the case.

2. The mines were *fresh laid*, and therefore were more likely to be in good condition than if they had been laid some months and had got stale.

3. The preliminary bombardment was omitted from the programme. Had it taken place, it *might* have resulted in much greater injury to the defence than to the attack, owing to the works and armaments at Milford Haven being old and imperfect as compared with the power of the attacking fleet—but it *might* no doubt have been otherwise.

On the other hand, the circumstances which favoured the attack were numerous—

1. It was agreed that, for fear of accidents, the ironclads were not to be attacked by torpedo-boats of the defence at the critical period of their entrance into the Haven, and which would have been the defenders' opportunity.

2. The "Hecla" carrying the countermining boats and gear of the attack was allowed to anchor and unload under the fire of the works of defence.

3. The obstructions were damaged by private vessels before the action commenced, and so boats could get through and attack the mines without much difficulty.

4. The attacking force were accurately acquainted with the position of the mines, and consequently they knew where to begin and where to end the operation of countermining a cleared channel through them; this of course would not be the case in war.

5. As in all such cases the effect of fire was minimized by the rule that only boats under electric light for a certain time were ruled out of action, and thus a few shots, directed by electric light, or prolonged fire directed by moonlight counted for nothing. Recent experiments have shown that a countermine boat can be rendered useless by a few rifle or machine-gun bullets, and no doubt even unaimed fire would have done much injury to the countermining boats of the attack.

6. Further, as was natural, the attacking boats were disinclined to go out of action when ordered to do so by umpires until they had finished the task of destruction set them, and were soon found in

the thick of the fight again. This indomitable spirit is the life of our Navy, but it produces somewhat anomalous results in peace practice.

7. The channel so skilfully cleared by the naval countermines was only half the prescribed width, and thus only half the work was really accomplished.

8. Finally, it was of course known that the mines were harmless, and although some ten large and four small mines were fired by contact or by observation during the course of the attack, no notice was taken of them, probably the small blowing charges were not observed. Hence the whole deterrent moral effect was absent, upon which so much depends in actual warfare.

The deduction I make from the Milford Haven experiments is first of all that our military organization for defence of harbours is at present lamentably defective, in fact, we have no such organization at all. Our naval organization for attack, on the other hand, is excellent. Yet with all these advantages it would appear that the destruction of a submarine mine defence is a most serious and dangerous undertaking, for although the umpires' report on the detailed results of the operations has not yet been rendered, it is already well known that the countermining operations had not resulted in the complete clearing of a safe channel of full width through the mine-field, and that the measure of success attained cost the attacking squadron excessively heavy losses. No fleet in the world has brought the system of countermining to the same degree of perfection as has been attained in the British Navy, and if they found the overcoming of very imperfectly organized defence a difficult operation under peace conditions, *a fortiori* under war conditions a less perfectly organized naval attack would have to make tremendous sacrifices before they broke through a combined defence of mines, guns, and torpedo-boats properly organized and drilled as I hope ours may be in future. For if we have learnt something of the difficulties to be encountered by an enemy in such an attack, and notably the absolute need of a calm quiet place in which to make his preparations for countermining, we have also learnt where our weakness lies, and that is *mainly* in the want of a suitable organization and training for the proper combination with artillery fire of the new means of defence which have quite recently come into existence.

The problem to be solved in the defence of a harbour is a problem in tactics of a totally novel and extremely intricate character, and if we consider how many volumes have been written on the subject of the tactics of the three arms, and how much thought and careful training are required to work together infantry, cavalry, and artillery in a battle on land, there is little room for surprise that in our early efforts to combine in harmonious action heavy artillery, medium artillery, quick-firing and machine-guns, and infantry fire, submarine mines, electric lights, systems of signalling, guard-boats, and torpedo-boats, we should have made mistakes and have failed to obtain the full value out of all these varied and special weapons and means of defence. But I trust that the lessons we have learnt from those most

instructive operations at Milford Haven will not be thrown away; that they may soon bear fruit, and that a great advance in the knowledge and practice of these new amphibious tactics will be evident on the next occasion when similar combined operations may be undertaken. Former experiments at Portsmouth had made it evident that to succeed in the very dangerous undertaking of opening a passage through a submarine mine-field, darkness is essential to cover the operations of the countermining vessels. We are therefore in the preliminary stage of our new tactics launched at once into the difficult operations of night attacks and night defences. Every soldier knows the special difficulties which attend such operations, and when our business is to prevent an enemy from injuring or destroying delicate machines, and to use these machines at the right moment to injure or destroy him, it is evident that perfect training and prompt and skilful action are eminently necessary in harbour defence. The defence of our harbours is indeed a business which now calls for the exercise of the very highest gifts, and is a field of employment for the most scientific and able Officers.

No doubt when a body of Officers and men have been as well instructed in these new means of defence as our army is in field operations the task will be easier, but in all its branches it is eminently scientific; and whether we direct our attention to the heavy guns worked by machinery and having their fire directed by the beautiful system of position finding, of which Major Watkin, R.A., is the apostle and Captain Lewis, R.E., the prophet, or to the system of submarine mine defence so patiently and thoroughly worked out and elaborated during past years by a series of Engineer Officers of whom Colonel Armstrong, the present head of this branch of defence, is perhaps the most eminent—or to the electric lights to guide both fire and mine defence at night—to the signalling system by which co-operation must be insured, or to the flotilla to meet the naval attack on its own element, we see everywhere the necessity for the very highest development of scientific skill, and for the exercise of those attributes of pluck, promptitude, nerve, and coolness which have won for the British nation its high position amongst the other nations of the world. It will be evident that to ensure co-operation to the best advantage amongst all these elements of the defence a competent head is absolutely essential. An Officer who has at least a general knowledge of the duties of the various branches of the composite force under his command, and who is therefore able to exercise and drill them separately and together, so as to ensure harmonious working to the best advantage; such a head is a primary necessity for every port or main channel to be defended by a combined force of artillery, submarine mines, and defence vessels.

It might be supposed that these combined defences would be best undertaken by the Navy, whose training and ordinary duties have fitted them for dealing with such matters far better than those of most military Officers. And we might be strengthened in this view by the fact that most of the great Continental Powers have made the defence of their ports a naval rather than a military organization.

It is beyond a doubt that if this new duty were imposed upon our Navy, they would in course of time work out a most efficient organization on naval lines; but it would have to be a completely new organization. I believe I am fully justified in stating that not a man nor an Officer can be spared from the existing personnel of our Navy to undertake shore duties. The rôle of our Navy is attack, not defence, or rather defence by freedom to move wherever they might be wanted to meet an enemy or protect a friend. Our naval power must be felt at the utmost limits of our Empire, and we cannot afford to chain our fleet or our sailors to our shores. The *raison d'être* of the defences of our military ports is to give a free hand to our Navy, and to enable them to take the sea with the confident assurance that their bases of operations will be safeguarded in their absence. Without a Navy thus free to act in all directions, our Empire ceases to be a power, and our commerce is at the mercy of our enemies. With the great Continental nations the case is different. Their armies are to them what our Navy is to us—a necessity of their existence as free and powerful States; therefore, soldiers cannot be spared for the defence of their harbours, and that duty is given to their navies, which are to them of secondary importance. Besides, we have already the elements of a military system which, with some vitally essential improvements, will meet our necessities in the defence of our ports, and to break up this organization instead of improving it, and to throw an extra strain upon our naval resources, instead of husbanding their strength for their primary duties, would be a serious mistake.

When once we have placed the defence of each port under an Officer responsible to the General of the district for the complete efficiency of the defences of the port, as far as the means in men and material placed at his disposal will permit, we shall have made a great step in advance. A general system of tactics for such defences must then be elaborated and practised constantly at each port, and the Volunteer element must be widely encouraged to take a full share in these local defences. Local knowledge is so absolutely necessary for an efficient harbour defence, that the personnel must be localized as far as it may be possible to do so.

There are besides several other points in which our defence system is still wanting. Guard-boats are an acknowledged necessity to protect submarine mines against attack at night; but the best sort of vessel for the purpose—how these vessels should be manned, commanded, and armed, and how they may be employed to the best advantage, so as to co-operate with the artillery in keeping enemies at a distance, without obstructing the fire of the guns or being fired into themselves by mistake—are still questions which have not been fully solved. The use of torpedo-boats to combine the element of attack with that of the defence, as always should be done as far as possible, is another question still somewhat unsettled.

But I would reiterate, as impressively as I can, that the primary need is for proper organization and command. We have most of the elements of a good harbour defence more or less developed, but no

organization and no commanders for combining them—no acknowledged system of combined tactics and drill.

A General who can handle infantry, cavalry, and artillery with ease and skill at Aldershot or on the battle-field must inevitably be quite at sea when suddenly placed in command of a semi-naval force to meet a naval attack. The probable nature of this attack, and the means to be used and how best to use them to resist it, are all unknown to him. Not even a Napoleon or a Wellington could handle such a force effectively without previous training and practice, and some knowledge of the different arms under his command. The money spent on guns, mines, and all that belongs to harbour defence is well nigh thrown away unless we have also a well-arranged system of using them in combination with one another, to accomplish their common object.

An army in which the three arms acted independently or were under the command of a General ignorant of tactics might indeed win the day against another army equally without organization by sheer valour, but if opposed to an army thoroughly organized and well commanded, the result would probably be very different. The case is quite similar with coast and harbour defence. Without proper organization and command, guard-boats may rush to the front and be annihilated before the action commences in earnest, and so the mines may be destroyed with comparative facility. Electric lights will not be used to advantage either for the artillery or the submarine mines. Gunners will fire into their own torpedo- and guard-boats; these will get in the way of the gunners and miners, and prevent them from destroying the enemy for fear of hurting their friends. Endless mistakes will be made to the advantage of the enemy and the irreparable loss of the nation, all for want of proper practice under well-qualified Officers held responsible for the harmonious working of the whole defensive arrangements.

Before passing to the consideration of some of the details of the artillery defence, I must allude to two new weapons for marine warfare which will probably take an important place in coast defences. The Whitehead torpedo has long since been adopted by the navies of all nations as an essential part of their equipment, and some even predict that torpedo-boats will drive ironclads off the seas. Be that as it may, and however much recent experiments have tended to show that their effect may not be so instantaneously destructive as had been anticipated, locomotive torpedoes are weapons of undoubted value, and all foreign Powers are adopting them largely. A new form of this weapon having a much longer range than the Whitehead, and being steered at will in any required direction, has lately been brought to such perfection that it cannot be ignored, and the Brennan torpedo will probably find its appropriate use in the defence of many channels in which the conditions are not favourable for the use of submarine mines, or in supplementing the artillery and mine defence of positions of great importance.

This torpedo has a speed of 16 to 18 knots, or as much even as 22 knots at short ranges, and it can strike with a fair degree of

certainly a vessel passing at full speed within 1,500 yards to a mile from its starting point. It carries a charge of 200 lbs. of gun-cotton, and would therefore presumably destroy the largest ironclad. It may be fairly assumed that no man-of-war would willingly venture within reach of such an unpleasant and unseen enemy, and that these locomotive torpedoes will be largely used in the future. Should the Brennan torpedo prove as useful as those who have carefully observed its action believe, and should it be introduced into the Service, the credit will be due quite as much to Sir Andrew Clarke, the late Inspector-General of Fortifications, who, against considerable opposition, has caused it to be worked out and perfected, as to the talented inventor himself.

The Nordenfelt submarine boat is another new and most promising invention, which has already been so far developed that several foreign Governments possess some of them, and the late incident in Greek waters, in which one of these boats ran the blockade *under* the blockading ships and got back again safely in the same way, is most suggestive. The main element of power in this engine is secrecy. It can travel like an ordinary torpedo-boat at 16 knots on the surface, and at will it can be submerged and can move at reduced speed in any direction and invisibly, and can so approach a ship without possibility of detection and discharge a torpedo at her. Doubtless the crew must possess both skill and daring. Their occupation is dangerous; but the moral effect of such means of defence would be extremely great even if their actual effect were less than might be expected.

I must now say a few words on the selection of sites for guns and the mode of mounting them for coast and harbour defence. We have already discussed the reasons which have led to a great reduction in the number of guns used for the purpose; but the question of how to mount and protect the guns so that they may be able to produce the greatest effect of which they are capable throughout the widest possible arc and up to the full range at which they are effective, while at the same time they are exposed to the least risk of being silenced by the enemy's fire is a question to which a complete answer has not yet been obtained. This is mainly an artillery question, yet it is one in which the artillery and the engineers are so closely connected and on which the whole system of coast defence so depends that I cannot pass it over.

In the selection of sites we are frequently governed absolutely by the natural features of the ground. If the shores of the water to be protected are but little elevated above the water-level, we are evidently obliged to use low sites for our guns. Such sites, if the water be deep enough for war ships to approach within 1,000 yards, are very unsuitable for open barbette batteries, because at ranges not exceeding about 1,000 yards the auxiliary armament of the ship would pour such a hail of small projectiles on to the battery that no gunners could serve the guns. Were the shore battery on a site 300 feet above the water, this fire with a more ascending trajectory would have much less effect, and guns in open emplacements might contend on

fairly even terms with the ships. In such low sites we are therefore driven to some expedient for protecting the gunners against this close attack, and we have the choice of disappearing mountings with overhead shields, such as have been tried lately with success for 6-in. and 8-in. guns, and which trials will shortly be extended to 9·2-in. and 10-in. guns; or of casemated batteries; or for very heavy guns which must be worked by machinery, we may use turrets or protected barbette on the system used on board H.M.S. "Collingwood." Should the water, however, be shoal to such a distance from the shore as to preclude the attack by heavy ships at close quarters, open barbette batteries may possibly be used even on such low sites. This form of mounting has many advantages. It is the cheapest; the guns can fire over a wider arc; they can be used with extreme elevation for long-range or high-angle fire; the batteries can be made inconspicuous, and the guns can generally be widely spaced, so that the effect of a bursting shell may not extend to more than one emplacement. These advantages, and more particularly that of economy, have led to the large use of open barbette batteries whenever they can be applied with fair chance of adequate protection to the gun detachments, both on low and on high sites; but on the other hand this adequate protection of the gun detachments is a problem not yet solved, and the gun itself is very much exposed. For breech-loading guns sloping shields attached to the carriage are proposed, which will protect the men and the breech mechanism from the smaller projectiles, but they increase the size of the target and would be worse than useless if struck by a heavy projectile; against a side fire they are of course useless.

Where sites elevated from 600 to 300 feet above the sea level are available, they present many advantages. From such high positions a ship is looked down upon, more or less, and as her breadth is always greater than her height out of the water, the target presented to the gunner is a larger one than is seen from a low site, and this target is also more vulnerable, as even in the case of ships with armoured decks, such as are now generally being built, the thinner deck armour is more liable to penetration even when struck at a low angle than the side armour. The moral effect produced by the fire from a commanding position is no doubt greater, especially when the ranges are comparatively short and the fire becomes plunging; while the effect of the fire from the ship is considerably less, and particularly so at the shorter and more destructive ranges.

On the other hand there are some disadvantages inherent in high sites. If the water be deep inshore some of it will be unseen from the battery on a high site, and a ship may run past without coming under the close fire of the battery. If the parapet be cut down to allow of firing with extreme depression the protection to the gunners and gun is proportionately reduced.

In many cases, as before observed, we are limited in our choice of sites by the features of the ground; but sometimes the choice is presented to us of a low site near the channel to be defended or of a high site, say 1,000 yards inland. As regards the safety

of gun detachments, the high site would doubtless be preferable, but as regards penetrative power of our projectiles, the balance would be in favour of the advanced low site. The question then has to be decided, perhaps, by a balance of economy. A more powerful gun *en barbette* on the high site may be cheaper than a less powerful gun in a turret, or casemate, or disappearing carriage, or some other description of protected mounting on the low level, and yet at the greater range may have equal or greater effect, and its chances of being disabled by the enemy's fire may not be far different. The cost of the site and of approaches to it, and of conveying the gun and its appurtenances to it will also have to be considered, and further, the question whether from the high inland site practice in peace-time may not be difficult or impossible owing to the damage that would result to houses between it and the sea.

It will be readily understood then that whatever be our opinion as to the relative advantages of high or low sites, or of different modes of mounting and protecting our guns, we must be prepared to adapt ourselves to the great variety of conditions which present themselves in practice, and that no theoretical rules can be of universal application. The higher velocities and longer ranges of the projectiles of modern B.L. guns as compared with those of the older type of R.M.L. guns have given no doubt a greater latitude of choice of sites than we had in former times, still the limits are soon reached, and when we consider the increased strength of modern armoured ships, and that penetration into iron decreases with increase of range—at moderate ranges about 1 inch for every 600 yards—it will be clear that we cannot retire our guns far inland without robbing them of much of their power of offence.

Foreign nations possess a large number of war-ships carrying armour to protect their vital parts over 16 inches thick, and this armour in many cases is steel or compound armour, the resisting power of which is considerably greater than in wrought iron, although the exact increase is perhaps difficult to determine as it depends mainly on the nature of the projectiles used.

The French alone have some seventeen ships of this class—eight of them having armour from 20 to 21½ inches thick—and it will be evident from the following table, giving approximate penetrations at different ranges into iron when hit directly, that with the less powerful guns increased range quickly deprives them of penetrative power; and it must be remembered that we have as yet none of the most powerful modern B.L. guns mounted in our coast defences.

| | Guns. | | | Penetration into wrought iron at ranges in yards. | | | | | |
|-------|---------------|--------------|----------------|---|--------------|--------------|--------------|--------------|--|
| | Calibre. | Weight. | Powder charge. | 1,000. | 2,000. | 3,000. | 4,000. | 5,000. | |
| M.L.. | ins. 17·72 | tons. 100 | lbs. 450 | ins. 24·4 | ins. 22·7 | ins. 21·0 | ins. 19·3 | ins. 17·6 | Only 4 mounted Only 2 mounted |
| „ .. | 16·0 | 80 | 450 | 24·4 | 22·7 | 21·0 | 19·3 | 17·6 | |
| „ .. | 12·5 | 38 | 210 | 18·0 | 16·2 | 14·5 | 12·8 | 11·0 | |
| „ .. | 10·0 | 18 | 70 | 11·7 | 10·0 | 8·4 | 6·7 | 5·0 | |
| B.L.. | .. | 110 | 820 | 32·0 | 30·3 | 28·6 | 27·0 | 25·3 | |
| „ .. | .. | 65 | 500 | 25·7 | 24·0 | 22·2 | 20·7 | 19·0 | |
| „ .. | 12·0 | 45 | 295 | 20·5 | 18·7 | 17·0 | 15·3 | 13·6 | |
| „ .. | 10·0 | 32 | 250 | 19·2 | 17·5 | 15·8 | 14·0 | 12·4 | |
| „ .. | 9·2 | .. | 160 | 16·0 | 14·3 | 12·6 | 11·0 | 9·2 | |
| „ .. | 6·0 | .. | 50 | 10·4 | 8·7 | 7·0 | 5·3 | 3·6 | |

From this it will be seen that irrespective of the chances of hitting, which of course are much greater at the shorter ranges, particularly in hazy weather, the most powerful of our M.L. guns, of which we have only six mounted in our coast defences, could not master the armour of the most powerful armour-clads now afloat at ranges over 1,500 or 2,000 yards; while the 38-ton guns, of which we have a considerable number, are quite unable to penetrate the armour of these ships at any range, and at ranges over 1,500 or 2,000 yards they would not destroy the less perfectly protected ships of this class.

The B.L. guns of 45 and 32 tons weight might possibly injure the most powerful armour-clads at ranges within 1,000 yards, and the less strongly protected first class armoured ships up to 3,000 or even 3,500 yards.

The B.L. guns of from 65 to 110 tons have power considerably in excess of the resistance of the best protected armour-clad ships now afloat even up to 5,000 yards range. But of these we have none at present on shore.

Within the limits of their power, however, it may be safely said that the balance of opinion at the present time is in favour of retiring the guns from the coast-line and in placing them widely (about 200 feet apart), as against massing them in batteries of guns close together on the shore; the positions of these dispersed guns being concealed as far as may be by assimilating them to their surroundings, selecting, if possible, positions which have backgrounds against which the guns and works will not show up distinctly from the sea. Judicious planting will often effect this object and so make the task of the naval gunner vastly more difficult than if he had a large distinct target like one of the great two-storied casemated forts of the last period to deal with. On these principles most of our new defences have been designed under the direction of Sir Andrew Clarke, who has consis-

tently advocated the principle of dispersion and concealment of guns, as against concentration and protection by iron or masonry.

It is curious and instructive to look into the history of the changes of manner which have occurred from time to time in emplacements for guns, whether for coast or for land defences. The introduction of what was then considered powerful artillery obliged engineers to adopt earthen parapets instead of masonry; but high-angle and ricochet fire led to the adoption of casemates instead of open batteries, the masonry being made strong enough to resist the artillery of the day. As artillery grew in power and accuracy, iron shields were introduced into the casemates to shield the guns and crews, and diminish the size of the widely gaping embrasures needed in thick walls; the later advances in artillery have now rendered masonry altogether inadmissible, and we are driven to cover our guns either by iron or by earth, using concrete in some cases to a limited extent. Earth is the favourite wherever it can be used on account of its cheapness, but who will predict what the outcome of the present state of change may be?

The accuracy and power of high-angle fire from rifled howitzers is now so great that traverses are but of little use, and if solid overhead cover be not provided, scattering and concealing the guns by every expedient that can be devised is the natural counter to this mode of attack. The degree of accuracy that may be attainable by howitzer fire from on board ship is still unknown; but recent experiments made by H.M.S. "Hercules" at a target on the sands at Shoeburyness seem to point to the conclusion that this mode of attack will not be confined to land sieges; but that whenever the position of a group of guns without strong overhead cover can be made out from the sea that group will be subjected to high-angle as well as to direct fire. Even a single heavy gun may possibly be attacked in this manner if mounted *en barbette* or with only a thin shield covering the disappearing emplacement. It must always be remembered also that the scattering of guns increases very considerably the number of men required to guard them from attack by landing parties, and the labour of looking after them and protecting them from injury in peace and in many other ways is inconvenient. We must face these difficulties whenever we decide on adopting the principle of scattering guns which from the point of view of making it difficult for a naval attack to silence the guns by artillery fire has otherwise much to recommend it. In this, as in all human affairs, perfection is not to be attained, and we are obliged to accept certain disadvantages whatever disposition or mode of mounting we adopt.

The hydro-pneumatic disappearing system of mounting has now been under trial with guns up to 6-in. calibre for some considerable time, and with these lighter guns the early difficulties have been so far overcome that the system is now practically adopted for all situations where the guns are likely to be exposed to attack on a very wide arc, and so have to be placed in pits for all-round fire, or, when they are necessarily on low sites; in some cases also where, owing to cramped sites, it is necessary for other guns to be placed on higher ground in rear and to fire over them; in that case the horizontal shield over

the emplacement protects the gunners from the danger of prematurely bursting shells fired by friends in rear, as well as from the enemy's shrapnel and splinters of shells which would otherwise search out the pit.

A pit, properly so called, which is not open in rear but is enclosed on all sides, is a most dangerous position for a gun unless so roofed over, as missiles of all sorts passing over the parapet are caught by the back wall and deflected round the inside of the pit with most destructive effect. The overhead shield averts this danger it is believed in a great degree, although experiment has not yet tested the point. Whenever it is possible a gun emplacement should be quite open in rear, so that projectiles passing over or grazing the crest of the parapet may fly clear away to the rear without being caught and exploded or deflected back. A glacis slope upwards in rear of an emplacement may not be injurious in this way, as projectiles ricochet on wards upon it; but it has the disadvantage of enabling the enemy to correct his elevation by showing him that he is firing too high; of this he has no indication when there is no solid background close behind the gun.

The hydro-pneumatic disappearing system has been successfully adopted for the 8-in. gun by the enterprising colonists of Victoria—and we are about to try it for the 9·2-inch and 10-inch B.L. guns with every hope that it may answer also for these heavier natures. If the trials prove satisfactory we shall then have the choice of mounting guns up to 32 tons weight either in barbettes, or on the H.P. disappearing system, or the heavier guns may be mounted in casemates or in turrets in those cases where the cheaper mountings are not considered suitable.

As regards casemates we are, as before observed, obliged now to alter their construction and to use iron instead of stone. I am in hopes that designs elaborated by Major English, who has for many years devoted his attention specially to the subject of iron defence, may prove suitable for converting some of our existing masonry shielded casemates into works capable of resisting modern artillery, at moderate cost. In their present state they are unable to resist attack by heavy B.L. guns.

The principle of the method proposed is to reduce the number of guns, to remove the upper tier, as a rule, from two-storied forts, to thicken the shields of the emplacements retained by using the shields of the other casemates, and either to replace the piers altogether by iron (of the Gruson hardened cast iron type), or to case the piers outside with a sufficient thickness of this material, and to strengthen them internally, and bind the structure together by an inner casing of wrought iron. The roof of iron girders and concrete would be made strong enough to resist all attack, and the magazines would be protected by concrete plated with cast iron. The cost of such remodelling would be about 4,500*l.* to 5,000*l.* per casemate. Details have not yet been worked out, and some preliminary experiments may be necessary; but the proposal appears likely to be of great value in many instances.

Casemates wholly of iron, as at Spithead, now need the additional plating which was foreseen as a probable future contingency when they were first constructed, and for which provision was made in their design.

The casemate system has the advantages of complete protection against fire of all sorts except that entering the embrasure. This opening must, however, be given considerable dimensions to allow of training and elevating and aiming the gun, and the rope mantlets, which were formerly proof against small arms and splinters, are now easily penetrated by the powerful machine and quick-firing guns lately introduced. The casemate has therefore lost in some measure its former security, even if made of sufficient strength to resist modern heavy projectiles. Its old disadvantages of limiting the training of guns to an arc of about 60° , and of also making extreme elevation for long-range fire very difficult without unduly increasing the height of the port, remain.

Nevertheless, in some low cramped sites where ranges are limited, and an important channel is to be defended by a powerful fire, the casemate must possibly still be used, and the necessary number of guns to command thoroughly the important water must so be protected. Breech-loading guns are much better adapted for casemates than muzzle-loading guns, as the gun itself gives a great degree of safety to the gunners when loading, as compared with the muzzle-loader.

The very heavy guns, over 45 tons weight, require machinery to work them; for guns over 18 tons, indeed, machinery would be advantageous by reducing manual labour and so increasing rapidity of fire and saving men—but for the heavier guns it is essential. The mode of mounting must therefore be suited to steam, or hydraulic, or other motive power, and this power may be taken into account in the works designed for them. Turrets, or protected barbettes such as are used on board H.M.S. "Collingwood," are at the present moment the most satisfactory methods which have been adopted for mounting such guns, although at Malta and Gibraltar we have adopted a species of barrette mounting with hydraulic machinery for working the guns and loading them under cover. Guns mounted on turntables, and protected by turrets or steel decks, have a great arc of fire, but they are liable to get jammed by heavy blows.

With modern long guns the turret has lost some of its advantages, as the long chase of the gun, its weakest part, remains exposed. This is still more markedly the case with the "Collingwood" mounting, in which the gun fires *en barrette*, and the breech only is lowered through an opening in a steel deck for loading. Many new designs are now under consideration for mounting these very heavy guns, of which it would be premature for me to speak. We have no such guns ready for mounting on shore at present, and the number of them likely to be required is not large, as the great cost of these weapons makes formidable inroads on any sum voted for defences.

I have alluded to Herr Grüson's hardened cast iron as a material for casemates and turrets. This material has been largely adopted

by the Italians and other Continental Powers, and recent experiments at Spezzia have shown that a turret of this nature is practically indestructible by even the most powerful modern guns. In his designs for these structures, Herr Gruson takes special pains to close the port through which the gun fires by means of the gun itself. In some cupolas for small guns for land defence the gun is absolutely pivoted in the port in the cupola wall, and no recoil is allowed to the gun in the cupola; but the whole cupola is arranged to recoil very slightly, being kept in position by very powerful springs. For small guns such a plan is possible, but for heavy guns the force of recoil is probably too great to allow of its being dealt with in this way, and it would seem that recoil is a necessity. The principle of muzzle-pivoting can, however, still be used in a less complete way.

Complete muzzle-pivoting obliges us to raise or lower the whole weight of the gun when depressing or elevating, and this is a serious business with very heavy guns; nevertheless, the port is so tempting a mark for the small, accurately shooting guns that we are more or less driven to this expedient. In our earlier casemates, the port was made large enough to allow of as much elevation and depression as was deemed necessary. In later casemates, the gun-carriages were arranged to raise or lower the trunnions of the gun for shorter or longer ranges, and thus but little height of port was needed for elevation and depression, and this was a decided gain, and with rope mantlets the casemates were fairly safe against projectiles of all sorts. The new quick-firing and machine-guns have now, however, mastered the mantlets, and we are driven to still further reducing the size of our ports. In a turret this is of little consequence, as the gun is laid by laying the turret; but in a casemate a very small port diminishes the field of view so far that the laying of the gun is greatly interfered with, and indeed can only be properly accomplished by means of position finding.

The mode of mounting machine and quick-firing guns in coast defences is a subject still somewhat unsettled. In iron casemated structures quick-firing guns have been successfully pivoted on the sills of ports where the men using them have fair protection; but as yet we have no suitable mounting for earthworks, as the essential principle of these weapons is that recoil is stopped altogether, or limited to about half an inch; the strain on the mounting is very severe, so that strong mountings are necessary. For machine-guns, with their relatively greater weight and small charges, the problem is much easier, and we shall have no difficulty in this case in obtaining convenient portable mountings. In both it seems probable that the element of portability must be largely used, and that the lighter classes of these weapons must be kept under cover during a bombardment, and placed rapidly in position when needed to repel a close attack. The heavier natures must be protected by iron, or must be mounted on some modification of the disappearing carriage, by means of which they can be raised into the firing position, or lowered under cover at will, and in all cases the positions of these weapons must be concealed as far as may be.

I have now alluded briefly to the general principles on which our coast defences are being prepared at the present date. To illustrate the subject I would refer to a special case and show an ideal defence of a harbour. I will take the well-known harbour of Plymouth as the example and deal with it as if it were a *tabula rasa* without any defences. There are always many solutions of such a problem. I will give one which commends itself to me and which will serve to illustrate the various modes of defence which I have endeavoured to describe, as applied to a very strong defence of a very important harbour.

First, it is necessary to guard against distant bombardment, which would now be possible within the zone shown in blue. This protection may be given in great measure by heavy howitzers in the outer line, but they must be supplemented by a few long-range guns, and also by torpedo-boats, either surface or submarine.

Next we must guard the entrance channels east and west of the breakwater, of which that on the west is the more important, and prepare to meet a close attack. For the attainment of these ends I would propose the following defensive arrangements.

In rear of the breakwater two 68-ton guns in a turret or other suitable mounting can act both against bombardment and near attack; on the heights right and left some heavy guns mounted *en barbette* plunge their fire down on a ship attempting to enter. The two channels are commanded at close range by casemated batteries at a low level on their shores. On Drake's Island and the Staddon heights some few guns command the inner waters, and would combine with the turret and the guns on the heights to crush any vessel attempting to force her way in, or which might have succeeded in passing the breakwater.

Submarine mines defend both the channels, and both outer and inner groups of mines add to the strength of the defence. The mines are partly electro-contact, arranged to explode as a ship touches them, and so moored that they rise and fall with the tide on Major Ruck's system, and thus are always invisible but always effective; some are either ground mines laid on the bottom, or buoyant mines moored at a considerable depth, and to be fired by observation at the moment when a ship is passing over them. The cables containing the electric wires are led to a secure test and firing room, where from time to time their electrical condition is observed, and where a tell-tale board shows when a mine is touched by a ship. When an enemy is at a distance the mines are rendered inactive by disconnecting the firing battery. At night powerful electric lights placed low down and as far as possible from the smoke of the guns, and having alternative emplacements so as to enable them to be placed to windward of the smoke, are in readiness to illuminate the mine-field and reveal any attempt of the enemy to tamper with the mines. The lights are thrown on reflectors which can quickly be renewed if struck by shot, the lamps and lenses being protected by strong parapets; and automatic, mechanical arrangements enable the operator to direct the lights from a distance where he is removed from their dazzling glare.

The guard-boats armed with the quick-firing and machine-guns are in readiness to frustrate any attack on the mine-field by the enemy's small craft, and their position and movements are so regulated by preconcerted arrangement that they will not obstruct or suffer from the fire from the shore—swift torpedo-boats or other steamers scout out in front and give notice of impending danger.

Brennan torpedoes would give additional security to the main channel of entrance, being manœuvred from Picklecombe and from near Cawsand. A third might form a reserve defence near Drake's Island, and a fourth might be worked from the breakwater fort.

The total of the defensive arrangements suggested for this ideal defence are as follows :—

- 4 68-ton guns—two of them in a turret.
- 18 10-inch guns.
- 18 6-inch guns.
- 20 heavy howitzers.
- 28 quick-firing guns.
- 4 Brennan torpedoes.
- 3 Nordenfelt submarine boats, submarine mines, electric lights, and flotilla for laying and guarding the mines.

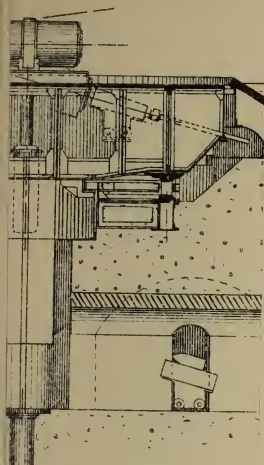
The total cost would be approximately—

| | £ |
|----------------------------------|----------|
| For guns..... | 350,000 |
| For works | 375,000 |
| For Brennan torpedoes..... | 28,000 |
| For submarine boats..... | 30,000 |
| For flotilla | 20,000 |
| For mines and electric lights .. | 30,000 |
| | <hr/> |
| | £833,000 |

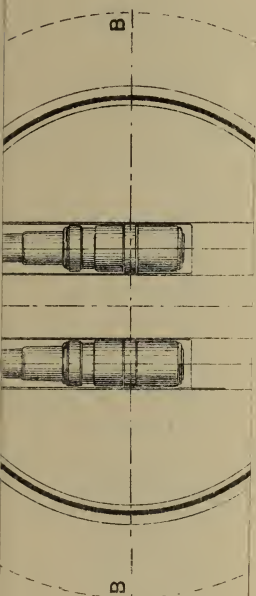
The guns are all worked by position finding from suitable observing stations on the heights, and ships coming within range would be exposed to concentrated salvos from all the guns bearing on them. The Commanding Officer would have issued his orders as to what ships were to be fired on, at what ranges and with what projectiles ; the guns would be loaded, and then laid by means of horizontal graduated arcs and elevated for range, in accordance with information sent electrically from the observing stations and exhibited automatically on dials in the batteries. The firing tubes are then connected for electric firing and the men stand clear, notice being sent electrically to the observing station that they are "ready." The observer having laid his telescope on a certain spot over which he has been able to predict that the ship will pass, if she does not suddenly alter her course, and on which the guns have now been laid, waiting for a few seconds until the ship appears in his telescope at the fatal spot, and instantly touching the firing key: the guns roar out, and send their shell with beautiful precision at the target. This sounds too complicated and scientific to be practicable ; but seeing is believing—the system is no longer a project, but an accomplished fact, which I have

witnessed in successful operation—and which I hope may soon be applied to every important battery we possess. The result of such firing as compared with the old independent firing, at ranges estimated by guessing, and at swiftly moving objects, is as different as light from darkness, and the percentage of hits will be probably increased tenfold. The reduced number of guns now adopted for coast defence purposes is thus fully justified by the increased efficiency resulting from this system of position finding.

Supposing the enemy's fleet to be unable to accomplish their object by bombardment, owing to the risks to which they are exposed by our long-range and high-angle fire. They would probably endeavour to silence our batteries by a closer artillery attack, if they could see no good prospect of success by landing troops to attack the guns on shore, owing to the presence of a sufficient body of troops to guard them. If, in a sufficient degree, they succeed in silencing our guns, they may try to prepare the way for entering the harbour past the batteries by destroying the submarine mines at night—and then our defences will be tried most severely, and good organization and command will be put to the test—in their absence the attack may succeed in doing this, and the defence may be broken through, but with good arrangements and defenders who have been trained and practised in performing their several parts, the efforts of the enemy to remove this barrier to progress should not succeed without the most serious loss to him. We may be justified in assuming that a defence well organized on the above plan would be so strong that no fleet could overcome it quickly or without very heavy losses. To deny the harbour to an enemy's ships for some days during which they continued the attack, would oblige them to lie off outside during this time, and at night they will be exposed to attack from our torpedo-boats, by day also they would be subject to this risk if we have submarine torpedo-boats. Storms may arise and drive them off, or our fleet may arrive on the scene and settle the matter by a naval action. The Milford Haven operations exemplified the last phase of such an attack, the attempt to destroy the mine-field. The enemy would choose a dark calm night. He would send on his torpedo-boats and light craft in advance to cover his attack, supported by ironclads in second line as a base from which the countermining boats would advance to endeavour to lay their mines and so to destroy those of the defence. The enemy's armoured ships would support the attack by their fire, and the smoke would help to obscure his operations; light vessels would endeavour to drive in those of the defence to prepare the way for the countermining boats—and then the electric lights, the artillery, especially the quick-firing and machine-guns, and the guard-boats would have to act in concert on prearranged plans so as to repel the attack and prevent any hostile boats from passing through our mine-field and injuring the electric cables by creeping or sweeping; or the countermining boats from laying their countermines. If the defence is well conducted the enemy should not be able to succeed in either of these operations; but there are chances in war, and they might be in his favour, and a partial success might be obtained. If he can



SECTION ON A. A.



PLAN.

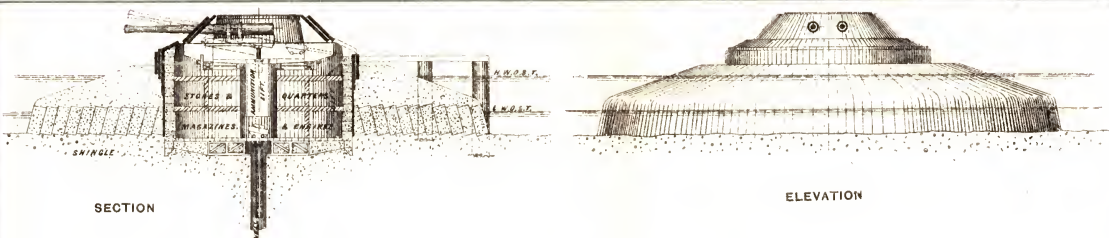
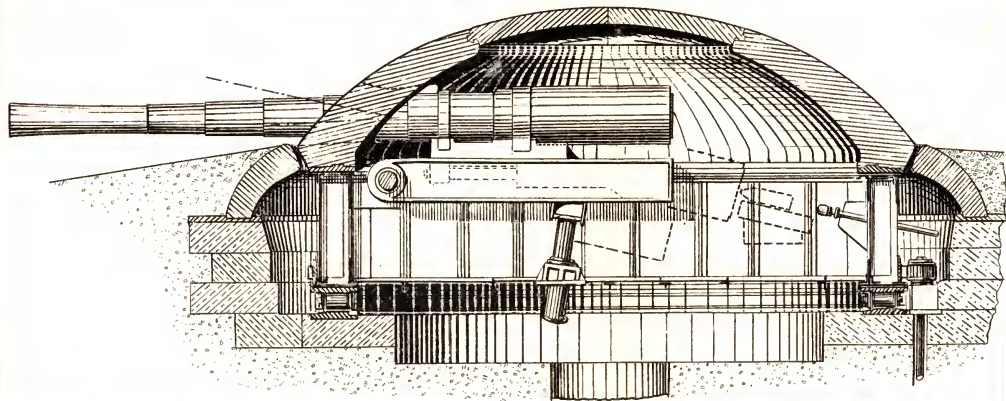
No. III.

D MOUNTING WITH
VED LOADING ARRANG
UNS.

SCALE OF FEET.

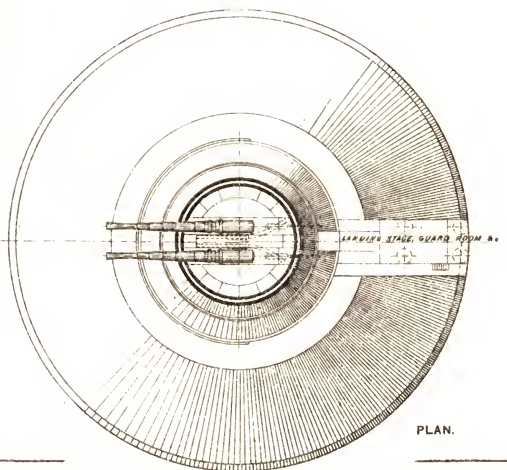
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No. I.—GRISON TURRET FOR 156-TON GUN.

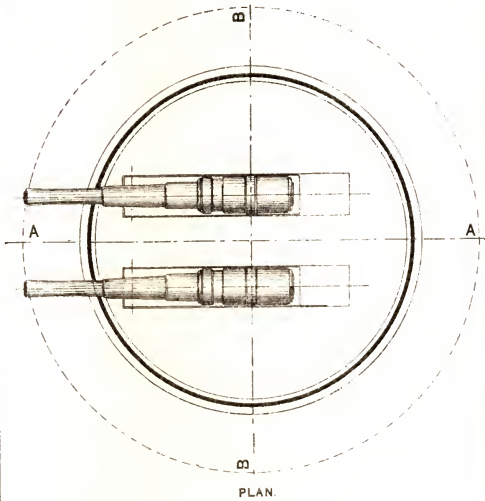
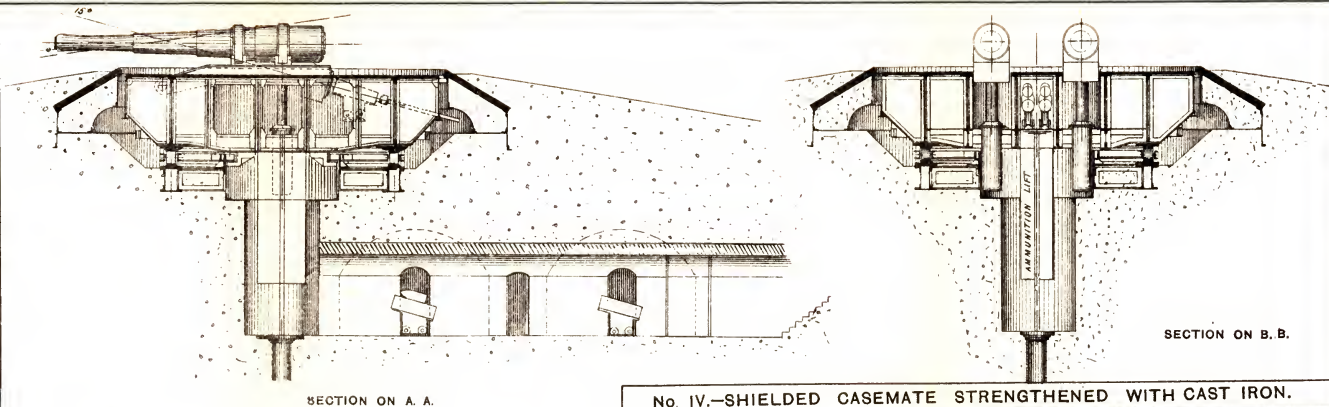


No. II.
WROUGHT IRON TURRET FOR 2 156-TON GUNS.

Outside dia. of Turret 64 feet.
Guns 12' 6" Centres, Recoil allowed 10 ft.
" Elevation 11° (loading angle), depression 3°
" may be loaded at any angle of Training.



SCALE OF FEET.

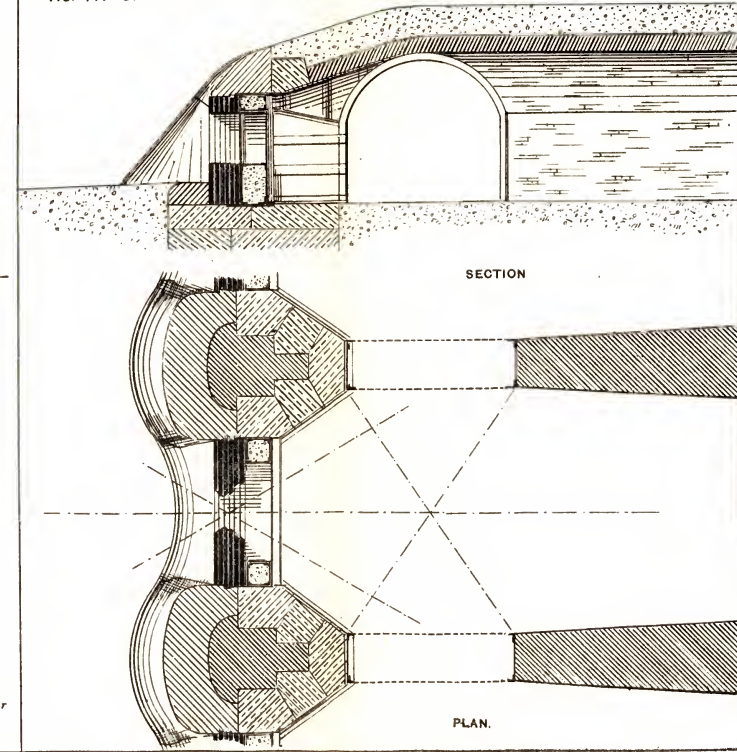


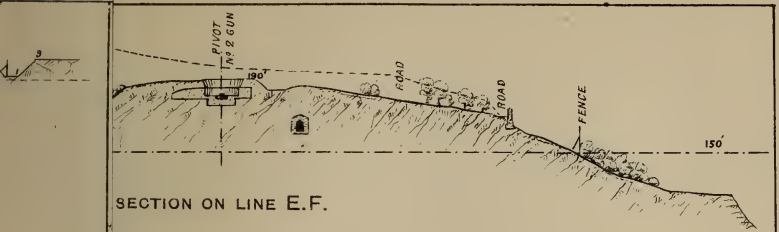
No. III.
COLLINGWOOD MOUNTING WITH STEEL DECK
AND IMPROVED LOADING ARRANGEMENTS FOR
2 68-TON GUNS.

SCALE OF FEET.

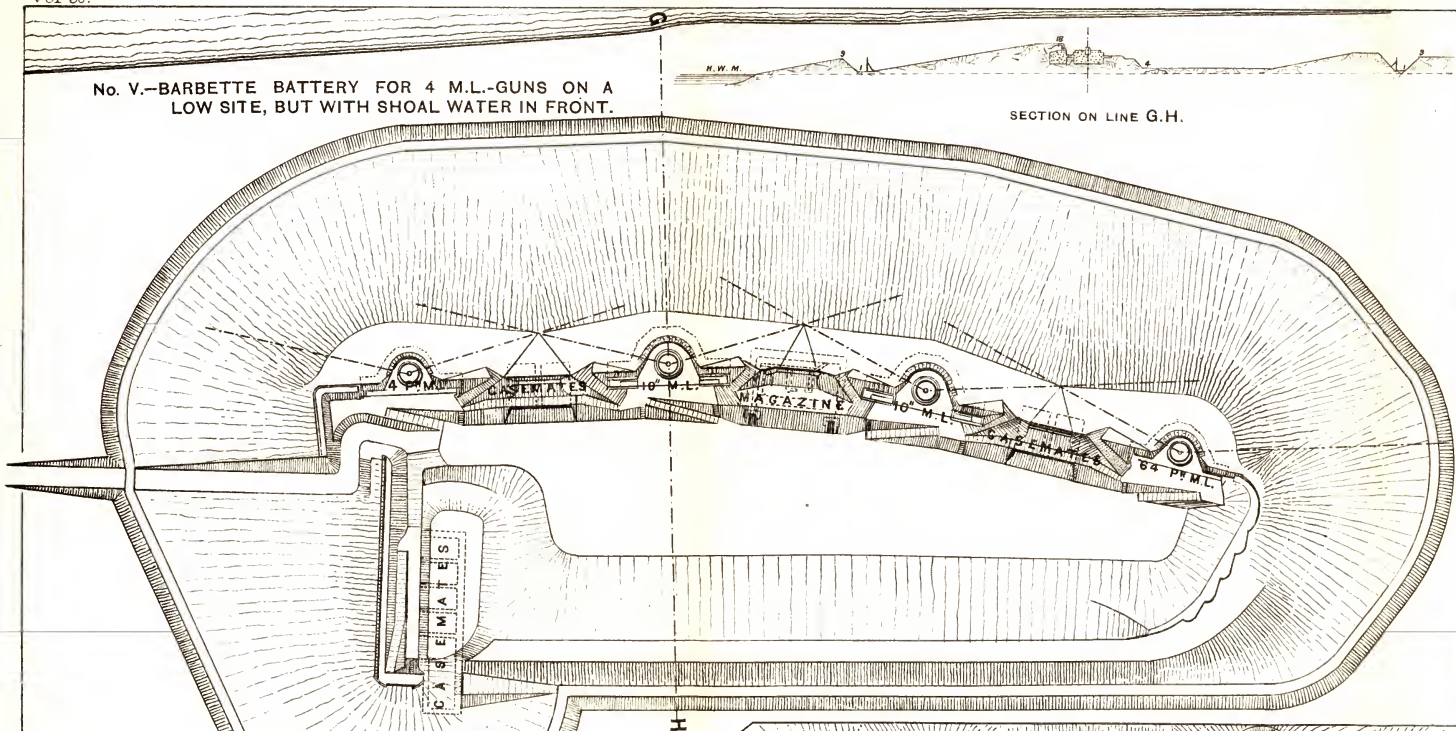


No. IV.—SHIELDED CASEMATE STRENGTHENED WITH CAST IRON.

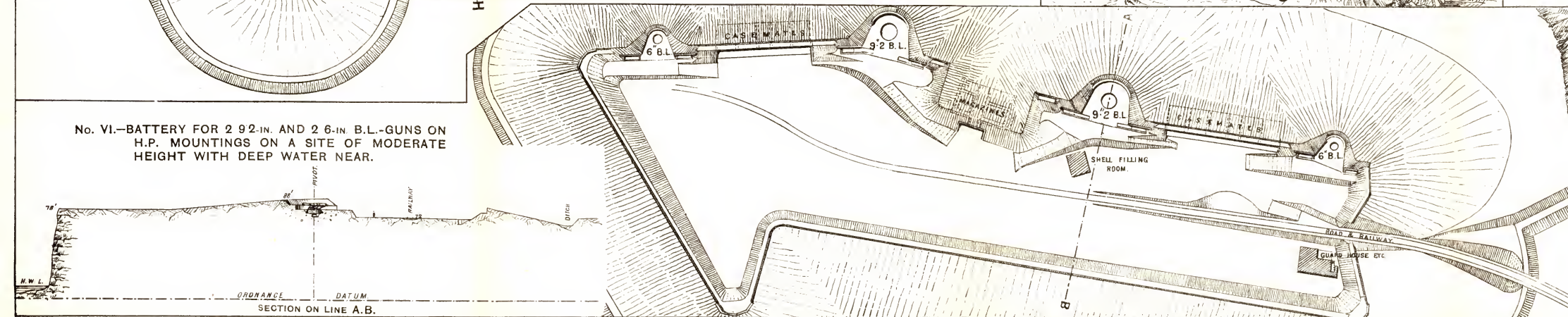




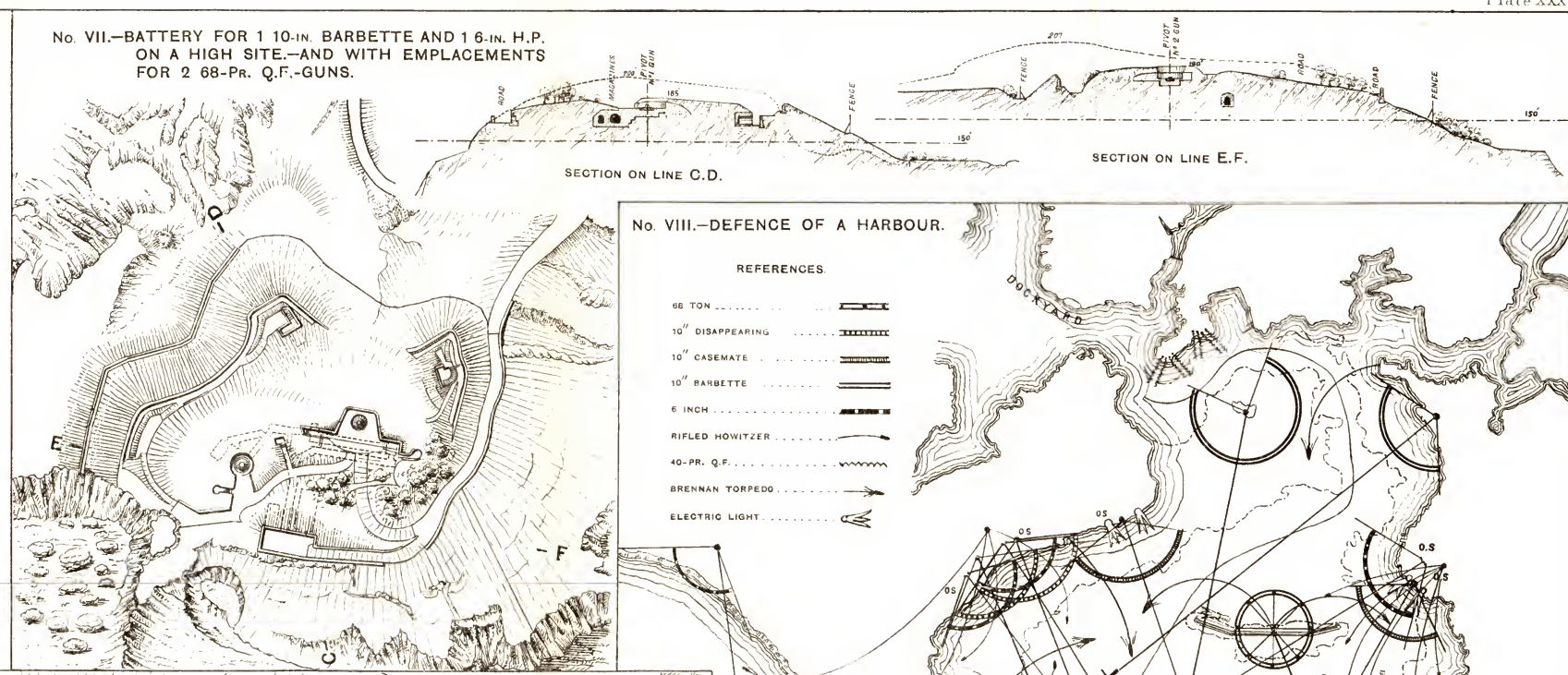
No. V.—BARBETTE BATTERY FOR 4 M.L.-GUNS ON A LOW SITE, BUT WITH SHOAL WATER IN FRONT.



No. VI.—BATTERY FOR 2 9.2-IN. AND 2 6-IN. B.L.-GUNS ON H.P. MOUNTINGS ON A SITE OF MODERATE HEIGHT WITH DEEP WATER NEAR.



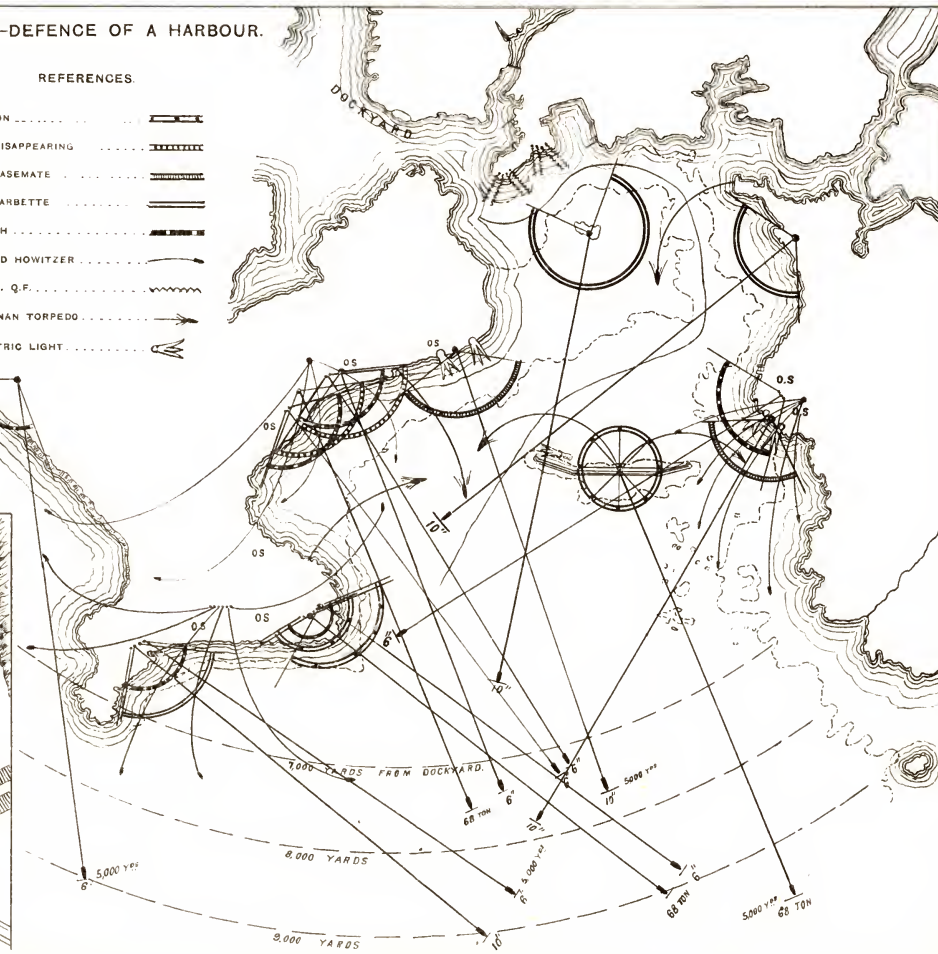
No. VII.—BATTERY FOR 1 10-IN. BARBETTE AND 1 6-IN. H.P. ON A HIGH SITE.—AND WITH EMPLACEMENTS FOR 2 68-PR. Q.F.-GUNS.



No. VIII.—DEFENCE OF A HARBOUR.

REFERENCES

- 68 TON
- 10" DISAPPEARING
- 10" CASEMATE
- 10" BARBETTE
- 6 INCH
- RIFLED HOWITZER
- 40-PR. Q.F.
- BRENNAN TORPEDO
- ELECTRIC LIGHT



at once advance an ironclad into the countermined water, and if he has so far overcome the fire of the shore batteries that he can maintain the vessel there during the following day and work on again from it with countermining the next night, and so on, until he has cleared a passage right through our mines, without our being able to replace them, he will have nearly attained his object, for if he has been able to overcome the outer and more powerful lines of defence, he will probably overcome the weaker line within, and be soon master of the situation. The inner line, however, will not have suffered much in the preliminary artillery attack, and it should be able to offer some considerable resistance in combination with the inner mine-field, the Brennan torpedoes, and any flotilla still in existence. Englishmen know well the advantage of a stubborn resistance to the last; the time so gained has often turned the tide of success, and until the last defence has been overcome, the enemy will not be able to hold the port. We have no example of such an attack. I conceive that it is a most improbable contingency, as no Power has a sufficient number of powerful ironclads to risk the loss of so many of them as would probably be disabled or sunk in a contest of so desperate a nature.

It must be understood, however, that the defence of Plymouth which I have described is an ideal defence. Of the existing defences it is not of course right that I should speak particularly. The great advances which have been made within the last twenty years in naval means of attack necessitate a corresponding progress in means of defence.

We cannot escape from the obligation. We can only console ourselves by the consideration that all other civilized nations are under the same necessity.

It is no doubt unpleasant for a householder to find that his roof has begun to leak. He may say that it is not so many years since the house was built, and he had to pay a heavy bill for building it—but the rain comes in and there is no denying it: he may put basins to catch the water, but he can't keep out the rain. Time and storms have done their work, and the roof must be repaired. Or a line of railway is made, and proper rolling stock is provided, and things go on very well for some years, but a rival line is made, and it has improved engines and carriages and permanent way and management, and the trains travel so much quicker, and the stations and carriages are so much more commodious, that everyone goes by the new line, and the directors of the original line learn by sad experience that they must keep up to the times or go to the wall, and much as they may grudge the expenditure it must be faced.

So it is with our national defences—we may regret that artillery and destructive weapons have made so much progress since we created our defences at so much cost, and that they now need expensive improvements, but the fact remains, and unless the nation faces the fact and provides the necessary funds, we are left in the humiliating position of existing as a free and independent nation only so long as our neighbours do not attack us.

The moral of my lecture is briefly as follows: Our national life depends on our commerce, and our commerce on our command of the sea by our Navy—Navy and commercial shipping depend on secure harbours at home and abroad.

Coaling stations abroad are to a certain extent being defended; commercial ports at home are either not defended at all, or defended only by mines, which though a valuable step in advance are sadly incomplete without guns and flotillas. Our military ports, defended at considerable cost some twenty years ago, need revision of their defences to bring them up to date—above all we need organization for the proper and effective use of the means of defence we possess. As regards resisting invasion in force, or the bombardment or seizure and putting to ransom of our sea-coast towns, we must trust in a great measure to our Navy, and to our volunteers, military and naval; and a well-defined system of general coast defence, by which the existing forces may be used to advantage, and expanded where necessary, is much needed, and should be considered and reported on by a suitable Commission and then acted on.

All this means expenditure, and expenditure counted by millions—but it also means national existence in case of a great war, and who can say when this may be upon us? When it comes my hope for England is that we may be found ready, if we are not it will be far too late to hope for any useful result from any efforts or sacrifices we may then attempt to make, and national disaster will be the inevitable result of national supineness and parsimony in time of peace.

The CHAIRMAN (General Nicholson): Having heard this very interesting lecture by Colonel Schaw, we shall now be extremely glad to hear any remarks that any Officers may have to make upon it. I need hardly say that it is an engineering question; but we as engineers hope that representative artillerymen and naval Officers will take a very considerable part in the discussion. I should like to say one word before we begin. To a certain extent this lecture by Colonel Schaw is what I may call an ideal one. It is an argument rather than an indication of a policy. He has touched upon one or two subjects which are at present in the clouds. I think it well that I, as Inspector-General of Fortifications, should make these few remarks before the discussion begins.

Lieutenant-General Sir EDWARD HAMLEY, K.C.B., M.P.: Mr. Chairman and gentlemen, knowing my old friend Colonel Schaw so well as I do, I came here expecting to hear a very important discourse, and I have not been disappointed. Everyone present must be conscious that he has been listening to facts which are new and striking, and which he may carry home with him and ponder over. There is one of Colonel Schaw's opinions which we must all of us most heartily concur in, and that is that the sooner we set about putting ourselves in a proper condition of defence the better. But that is not a new idea. It has been familiar to me ever since I can remember. It is still only in the way of accomplishment, and I fear that the difficulties in that way of accomplishment are not only not diminishing, but are constantly increasing. In the first place we have among us a body of politicians who trade on opposition to expenditure of all kinds—especially for the purposes of war—and they enjoy, unfortunately, a great deal of credit and influence, because they address a very willing audience, and because it is very easy to persuade people that it is not necessary to pay taxes. Then another difficulty is in the ever-increasing costliness of war material. A first-rate ironclad is now so costly that only a first-rate Power can venture to buy one. Guns cost each a small fortune,

and besides this there are all those scientific appliances of which Colonel Schaw has told us, and which mount up to such a sum that the defence of one port, Plymouth, as he estimates, would cost more than 800,000*l.*, and that estimate when it is stretched, as estimates are stretched in the course of execution, would probably amount to 1,000,000*l.*, and that is for one point on our coast only. Well, that affords a very strong argument for the enemies of expenditure and of defence. Another is the transient and progressive nature of war inventions, so that the invention of one year may almost be said to become obsolete in the next. Colonel Schaw has told us that a city may now be bombarded from a distance of 10,000 yards, and he truly says a short time ago that would have appeared to be fabulous. This question of range is going on progressing until one might almost, without seeming to be rash, predict that some day or other we may see the coast batteries of France and England cannonading each other across the British Channel. All this affords a great opportunity for the economist. Of course it is a very strong and a very impressive argument to be able to say, "It is of no use adopting this or that invention, because in a very short time it will be superseded, and therefore you had better wait for perfection." I do not say that is a sound argument—far from it. The sound argument is that we should make the best use in our power of the means that lie to our hand, and keep ourselves constantly prepared; but, nevertheless, it is a plausible argument, a striking one, and one well calculated to impress the popular mind. All these things make the outlook for defence somewhat unpromising, and perhaps the best hope of a better state of things lies in being able to persuade that ultimate paymaster, the British elector, to understand the case more clearly, and to come to a better frame of mind about it. To that end I know of no better means than such a lecture as that which we have just listened to, which puts the most striking facts clearly and forcibly before us. Well, we must take care not to suppose that because a great deal remains to be done nothing has been or is being done. A good deal is being done, and perhaps in a somewhat quiet way. For instance, it is very satisfactory to know that our northern ports and rivers on which we must rely in case of war for our supplies of food are being placed in security, and that at no very extravagant cost. It is also very satisfactory to know that that inestimable force—our Volunteers, is supplying engineers to take charge of these defences in their own localities. Now, one of the most striking facts which Colonel Schaw has brought out is this. It might have been supposed that when a Government had provided sufficient war material for the defence of some of our great ports, as Plymouth or Portsmouth, and had provided works and guns, and all these scientific implements, nothing remained to be done but to leave it to the Officer who happened to be in charge to conduct the defence in case of need. But now we see that the accumulation of war material, though a very important step, is only a step; that it is still necessary to have a head to animate and inspire and conduct all these scientific appliances to their proper end, and that he must be a man of great scientific acquirements in order to deal with these highly scientific implements, as well as a man of skill and intelligence. I therefore do hope that the Government is already taking into consideration how to train Officers who shall be competent to conduct such a defence as Colonel Schaw has pictured for us; and I hope also that the Government will lay to heart every word of Colonel Schaw's lecture. It is no mere complimentary phrase to say that we are greatly indebted to Colonel Schaw, for I know very few who have possessed the opportunities, and who now possess the knowledge and ability, to enable them to set this matter before us as he has done. I think you will agree with me that it is very unfortunate that an Officer who does possess this knowledge and this ability should be lost to the Service by the operation of an arbitrary rule, and it would be a very fortunate thing if some means were devised by which such abilities as his might still be made useful to the State. Of this I feel quite sure, that Colonel Schaw will carry with him into his retirement the good wishes of all the present audience.

Major-General Sir WILLIAM CROSSMAN, K.C.M.G., M.P.: In making one or two remarks upon the very able lecture which has just been delivered by Colonel Schaw, I do not intend to enter at all into any details which he has proposed with reference to the defence either at land or at sea. But I think he has made one most important remark, namely, that organization is the thing that we want. I have

served in the Army, I have served in garrisons, but I cannot say, nor do I think that anyone can tell us, who in the event of an enemy's fleet appearing before Portsmouth or Plymouth would be in command? We have in those places a Commander-in-Chief, but with all due deference to the Officers of the Navy I think without the affix "Naval," that title is a misnomer. We have also a Lieutenant-Governor as we have at Portsmouth, but it is not settled to this day who it is that would command in the time of actual warfare. I think that is a question which ought to be settled, for without a head no defence is possible. There is another matter with regard to the defence of ports with which I have been connected for some time, that is, the submarine defence. My own opinion always has been that that defence ought to be in the hands of the Navy. Although an old engineer myself I think that anything conducted upon the water ought to be done by sailors, and I say this notwithstanding the fact—which my friend Admiral Cooper Key strongly put before me many years ago—that in time of war every sailor will be required to man the ships of the Fleet. Still I think that under the naval organization there might be a body of men retained altogether for harbour defence who would conduct the submarine defence of the various ports of the kingdom. There are also the Volunteers, and I am glad to see in the northern part of the country where I come from that the volunteers themselves are now taking up that question of submarine defence to a very great extent, and doing it well. They are carrying this out under the direction of the Engineers, principally of my friend Colonel Armstrong, than whom no man has done more to carry on this nature of defence in this country; but I repeat that I would rather see all these Volunteers for submarine defence under a naval organization than under a military one. It has also been said that the question of artillery and submarine defence is very much mixed up. So it is no doubt, for submarine mines without artillery and without guard-boats are of no use whatever, and therefore one argument for putting the submarine mines under the control of the Navy is that a flotilla of guard-boats and offensive torpedo-boats is absolutely necessary, and these can only be manned by sailors. As regards the artillery, we have at Portsmouth a thousand of the finest men of the Service in the Royal Marine Artillery. These men are trained as well as any gunners can possibly be, and I do not see why they, instead of being kept in barracks, should not be manning the forts of Spithead. It has been stated that perhaps a coast brigade might be formed for taking charge of the whole of this coast defence. I am very loath to multiply the number of various corps, but I think that if one man is not in command, he ought to be, at these various fortresses, whether a sailor, an engineer, an artilleryman, or an Officer of the line. I believe for my part that the whole of the forces could be brought to work together amicably and well. Colonel Schaw has spoken of a Royal Commission to go into this matter. Well, I have had some experience of Royal Commissions, and I know that their Reports are generally relegated into a pigeon-hole. What I say is that it is the duty of the First Lord of the Admiralty and the Secretary of State for War themselves to adopt some principle and to make such arrangements as are necessary, taking the advice of those men who are best qualified to give it.

Admiral the Right Hon. Sir COOPER KEY, G.C.B.: Sir, during the reading of this admirable paper, I have listened to every word with the closest interest. I had not the opportunity of seeing the paper beforehand, or I should have studied it more carefully, but I have followed the able lecturer closely, and with some experience of the subject. It has reference not only to the attack of fortifications, but to the defence of harbours, which is a matter to which I have paid attention for some years. I followed Colonel Schaw with that intention to criticize which I think we naval and military men all have with regard to each other. We like to criticize our own brother Officers and those of the sister Service when their opinions do not exactly agree with ours. But in this case I must confess that I cannot find a single sentence with reference either to the principles or detail that he has advocated for the defence of our ports against attack by an enemy's ships with which I do not agree. I say this advisedly, for every point, both of the detail and of the general subject, has been of interest to me for many years. I will refer only to two questions, on which I feel with him most urgently. The first is, on whom the responsibility for the submarine portion of the defence of our ports should rest. I do not agree in this matter with Sir William

Crossman, who has also kindly suggested that the Royal Marine Artillery, on whom we rely as a valuable auxiliary arm of Her Majesty's Navy, should be taken from us in order to do part of the duty of the artillery or of the Army, by forming the garrison of the fortifications of Portsmouth. Such a measure would deprive us, I will not say of our right arm, but of a very valuable body of men who belong exclusively to the Navy. This suggestion I have opposed whenever I have had the opportunity of doing so, holding, as I do, that every naval Officer and every seaman and marine should be available at all times for service afloat. I cannot state too emphatically that we shall require all our trained Officers and men in the event of war; and if you were to take from the Naval Service the large number of Officers and men that would be required to protect our ports with submarine mines, you would find that it would seriously weaken the Navy, not only in regard to the large number required for such duties, but they must be taken from the most highly instructed portion of both classes. It is of no use leaving Officers and men for the defence of our ports who have not been carefully trained, and it is those carefully trained men whom we want afloat for the service of the fleet, when untrained men will be only an encumbrance. If we are to leave many of our best Officers and men shut up in ports during war, whether they may be on the active or retired lists or seamen pensioners, I say that the Navy would have to be largely increased, with the sole object of relieving the Army of their proper duty. This is a point on which I feel very strongly, and nothing has pleased me more than to know that foreign countries such as Germany and France entrust the defence of their ports to the navy. We may thus be assured that many of their best Officers and men will be shut up in their ports, and must be withdrawn from the strength of the navy in time of war. Another point on which I agree with Colonel Schaw, and which is one of importance, is the idea of separating guns for the defence of our ports, and of placing them at a certain height, say from 100 to 300 feet, where their power against ships is more destructive than when low, and where they are much safer from fire from the ships. I have long been of opinion that by separating or isolating guns instead of blocking them together in forts as we were formerly in the habit of doing, and as we have done somewhat of late years, we have the very best possible defence against attack by ships, such guns being in earthworks mounted *en barbette* at heights from 100 to 300 feet above the sea, and placed where no two guns can be aimed at by the same gun. This principle I have advocated ever since I was engaged in the action of Olligado, in 1845. I was afterwards consulted about the defence of Plymouth Sound, and I suggested that we should sprinkle guns all about the woods of Mount Edgcombe wherever they could be placed, which I know would be the best defence you could have for Plymouth Sound. Feeling so favourably as I do as to the value of this paper, it is rather ungracious on my part to find fault with the name "Coast Defence." If our fleet happened to be drawn off to the West Indies, as Nelson's was in 1805, or to the Mediterranean or elsewhere, by a feint movement on the part of combined enemies, consisting perhaps of strong military Powers, affording them an opportunity of making a descent on our shores, they would not come to attack Portsmouth or Plymouth. Their object would be to throw a large force of 200,000 or 300,000 men on shore wherever they could find a landing, but they would not come to the strongly fortified ports like Portsmouth and Plymouth. I should not have said a word on this subject if the paper had not been entitled "Coast Defence." *It is of great importance that we should know what preparations would be made in the absence of our Fleet for meeting a force that might be thrown on our shores in such circumstances*, and I would suggest that this paper might have been called the "Defence of our Ports." "Coast Defence" is really a separate subject, and one of signal importance.

Captain P. H. COLOMB, R.N.: I am sure at this late period of the evening you will not expect me to make very many remarks, especially as I think that the three speakers who have preceded me have pretty well covered most of the ground. Everybody who knows Colonel Schaw, and is aware of the position he has filled so admirably, must have come down here—and the large audience that we have had shows the fact—with the expectation of hearing a very interesting and valuable paper, and that we certainly have had. But my gallant friend Sir Cooper Key used the word "ungracious," saying that it was rather "ungracious" perhaps to criticize

a particular point in the paper. Well, I think myself rather that the business of this audience is to audit, that is, to criticize. We are here to do it, and we should not waste time in going into matters which are not strictly in criticism of the paper. I have been struck all the way through with one point, and that is a point which appears in everything which is said or done in the way of defence. Every lecturer, every person who reads a paper, even the talented gentleman who wrote "The Naval War of 1887," and also the still more talented gentleman who wrote "The Battle of Dorking"—they all start with two propositions; one is that we must have an overwhelmingly powerful Navy, and the other is that whenever we start with anything in the way of home defence we are to suppose the Navy does not exist. We are always to get rid of the Fleet somewhere before we begin. What I think about that is, first, that it is not the way to get money out of the country, and secondly, that it is hardly practicable or politic. My own impression is that, if I had to read a paper of this kind, I should take the subject entirely in view of the actual state of the Navy—what the Navy is likely to do, what it might fail in, and how its failure might be remedied. Then under those conditions I should have said, "Now let us come to our coast defence in view of the facts of what the Navy can do and is likely to do." I doubt altogether the wisdom of prescribing a system of coast defence which is to come before the public as the defence against an attack by an ironclad fleet. It is quite true that Colonel Schaw guarded himself by pointing out that such an attack was in his opinion impossible, but I doubt whether the public will guard themselves in the way that he has done. I fear much that, seeing how tender the public are at present on the subject of coast defence, they may look more to the defence of the harbours and ports of the kingdom, and less to the tremendously important matter of the observation of the enemy's ports—that they may look more to what the enemy may do on our own shores, and less to what it is our business to do on the shores of the enemy. I should not mind it much if there were two separate funds that you could draw upon, but we have to recollect that in this country we draw upon one fund; that if we take away from that fund for one purpose we cannot spend from that fund for another purpose, and therefore I think it will be more prudent in us all, both soldiers and sailors, if in discussing this special question of coast defence we always recollect that the strong probability is that there will not be those immediate disappearances of the whole of our heavy ships, but that what we are liable to on the coast of England is a sudden light attack, which may be organized from one of the enemy's ports, by light ships specially prepared slipping through, as we know that they will slip through, our blockading fleet. I think at the beginning we ought to stick steadily to that and go for it—to say that we want our coast defended against these light attacks, and more especially that we want the waters surrounding our ports defended against the simplest and easiest attack which the enemy can make upon us, that is to say, upon the ebb and flow of our commerce from those ports. I can hardly imagine an enemy deliberately putting himself under gunfire, and under a chance of submarine mines, when he can do us infinitely more damage 5 or 6 miles off the port in the destruction of the commerce which is flowing into and out of it, and so I think the object we should have in view is to aim at guaranteeing our coast and ports against light and chance attacks. I agree very much with what the speakers have said as to how this is to be done. I feel quite confident that we must put the coast defence in the first instance under a separate fund, and next under a separate organization. I quite agree with what Sir William Crossman has said, that the marine part of it must be under trained sailors. I quite agree also with Sir Cooper Key, that those sailors must not belong to the Royal Navy; they may have passed through it, but it is the volunteer seamen about the ports, and the pensioners, and the retired Officers, if you like, of the Navy, who should be utilized and employed, put into a distinct corps, and separately voted for, in order that the defence of the whole coast of England may be treated in a definite and proper way, and always in view of the fact that it is going to have the assistance of the Navy in blockading the enemy in their own ports.

Colonel CRAWFORD, R.A.: Having just returned from Hong Kong, where forts on the new system of *scattered* guns are being constructed, I should like to make one remark on the artillery question of armament, and that is to take exception

altogether to mounting our coast batteries with howitzers. From the Inchkeith experiments it appears to have been assumed that because the *shell* fire from the ships against the fort was very destructive, a *shell* fire from the fort against an armour-plated ship would be equally effective. I maintain that while ships might be armed with howitzers to fire at earthen forts, coast batteries should be armed with *armour-piercing guns*. The object of the ship commander would be to destroy the gunners and earthworks by high-angle fire; but the object of the fort commander would be to sink or disable the armour-plated ship by a *direct fire*, as hard hitting as possible. The chance of hitting a ship at all by high-angle fire is most remote. Take a range-finder (Watkin's depression) and direct on to the water-line of a ship, and read the range, then direct on to the top of the bulwark; the difference between this and the water-line range will be some 200 or 300 yards, so that for *direct* fire the effective area of fire would be 200 yards \times length of ship, while for *high-angle* fire it would be necessary to drop the shell on to the deck of the ship, a very remote contingency, especially for ships in motion. Howitzers have been advocated "to prevent ships engaging forts from anchoring." Experienced naval Officers assure me that they would never think of anchoring, but would move at as high a speed as possible; and looking at the matter from the fort point of view, if a ship did anchor, her range could be accurately determined, and a *direct* fire from the forts should soon make it her last anchoring place. As Admiral Sir Cooper Key has already pointed out, the most effective deck fire would be a *direct* fire from elevated batteries. I trust, therefore, that our coast defences will be armed with *guns*, and not howitzers, as the modern ship-of-war is, I consider, invulnerable to howitzer fire. The Admiral on the China station made the remark, "If I were attacking these forts, I should like them to be armed with howitzers."

General Sir ANDREW CLARKE, G.C.M.G. : With reference to what Colonel Crawford has just said as to the howitzers at Hong Kong, I may state, as the Officer who advised sending these howitzers to Hong Kong on the emergency that had suddenly arisen in the political state of Europe, the object of sending those howitzers was, of course, to apply them as they were usually applied, namely, for high-angle or vertical fire; but what was my astonishment to hear afterwards, that instead of being applied in this way, they were really placed in batteries as if they were intended for direct fire upon ships, and not for vertical or high-angle fire; so the object for which they were sent was entirely misconceived, and they were not really used for the purpose for which they were intended. Everybody is well aware that the area of accurate firing with reference to howitzers is of course very limited in comparison with the area offered by direct fire—that there is a larger margin of chance of missing in vertical firing than in direct firing. But still, as Colonel Schaw has pointed out very clearly in his lecture, the modern rifled howitzer has shown very extraordinary results. I do not know whether Colonel Crawford has had any large experimental trials with howitzers to enable him to judge how far he can depend upon their effective firing, and if he could have given us some information as to that point it would have been very valuable as a guide in future. I believe it is the general opinion of naval Officers—and there are many present who will correct me if I am wrong—that nothing checks the approach of an enemy's squadron so well as vertical fire; it will at least tend to keep them from anchoring. I admit, however, that had I had at that time a number of 10-inch rifled guns to spare, I should have preferred sending them instead of the howitzers; and in case of an attack upon Hong Kong I think they would be found very useful. With reference to the lecture itself, of course my whole sympathy goes with the principles laid down so admirably by my old colleague Colonel Schaw. And here I may say, I do not think Colonel Schaw meant by the words "Coast Defence" quite the meaning that Captain Colomb applied to them. I think he was merely speaking of the principles to be applied to the technicality of coast defence, as we engineers look upon it, and not of the larger and more political question that Captain Colomb alluded to. With reference to the principles that he has laid down, it is a great satisfaction to me to find that they have been so admirably put forward by my old colleague. At the same time, whilst recognizing the force of the earlier part of his paper, I must take a very strong exception to the

instances he has given in its application. I must protest against the absolute departure from every principle, so far as protection for heavy guns is involved, which is laid down in the earlier part of the paper, when he comes to a project for the "ideal defence" of Plymouth. With much of that defence, floating and submarine, and increasing the gun power of Plymouth, I entirely agree; but there is the old idea coming back again, that all these guns are going to be put into cupolas, or that we are going to have revisions and new adaptations of iron and granite. One-half of the large charge of near a million of money which has been brought forward in order to secure the defence of Plymouth goes into iron. Now the policy which has guided me during the last four years is to think first of all of the power of offence given in the gun, and then afterwards to make the best and simplest arrangements possible to protect the gun and the men who fight the gun.

The CHAIRMAN: You are not here, Sir Andrew, upon your own defence, but for the purpose of discussing the paper.

Sir ANDREW CLARKE: I agree. I am now defending Colonel Schaw against himself, for I am protesting against his departure in his ideal defence of Plymouth from the principles which are laid down in his paper, in recommending that we should again have recourse to iron; and I am criticizing the actual application of this paper that we should at the present time—the time may come when this country can afford, but it has not come yet—increase the armoured defences of Plymouth, that is to say, perpetuating an "ironclad on shore." To show how impossible it is to obtain finality with reference to this very question of armour, I may state that in 1873, when many of these works were half finished, an Officer, whose genius I respect, lecturing in this theatre on this very question of iron, said, "We may therefore venture to hope that comparatively little, if any, expenditure will be necessary to maintain the present invulnerability of our iron coast defence." And now, Sir, before these coast defences at Plymouth have been armed we are practically asked to reconstruct them again on the same lines. I therefore protest against a violation of the very principle which has been laid down by Colonel Schaw in the earlier portion of his paper, and which has received the confirmation of Sir Cooper Key. Another distinguished Officer who had a good deal, in fact nearly everything, to do with the construction of these forts in 1870, writes in a published paper: "The iron-fronted forts which have been wisely adopted will for centuries stand against any attack." That was written in 1870; yet we are assured that there is not a single iron fort we have got at this present moment which will stand against modern guns; and what I wish to urge is that not one single farthing should be spent on ironclad forts until we have got the guns necessary to arm the existing defences of the Empire.

Lieutenant GLADSTONE, R.N.: I should like to speak from the point of view of a naval torpedo Officer about that portion of the lecture which refers to submarine defence. Colonel Schaw says it is very necessary that a port should be ready at short notice to defend itself. With regard to that I should like to ask first of all how long it took to defend Milford Haven? Secondly, when it was defended, was it completely defended or only partially so? And, thirdly, how much of the whole defence of the kingdom was affected by the defence of Milford Haven? that is, how many men and stores were taken from other parts of the kingdom in order that these peace manœuvres might be carried out? With regard to the question of supplementing the fixed defence of a port by torpedoes, I think it is worth while pointing out that if such weapons were demanded there is no reason why Whitehead torpedoes should not be constructed to go 30 knots for an increased range, and which should carry a charge of 300 lbs. of gun-cotton. Such torpedoes would be naturally used from submerged batteries, and it is not necessary to do more than look at that chart of Plymouth in order to see how admirably they might be used. With regard to coast defence being in the hands of the Army, I here differ from the lecturer altogether. We have already heard an Officer of engineers saying that he proposes to put it in the hands of the Navy, and Sir Cooper Key says the engineers ought to have it. Sir, this seems as if the times are out of joint. I think in the first place it is not soldiers' work, and that pretty well condenses the whole question. I do not see how they can adapt themselves to it. The question of the mobile defence is a very important one, and the opinion is gradually gaining ground

that the mobile defence is the most important part of our defences. There is no doubt that torpedo-boats for coast defence must be in the hands of the Navy, and to have the fixed defence under a General and the mobile defence under an Admiral will lead to nothing but confusion arising from joint command. It only needs a little friction between the Admiral and the General to bring the whole machine to a standstill. The question of what men are used, is a matter of detail. I think the marine artillerymen would be far the best, and it is only necessary to expand the marine artillery in order that they may be able to do this work and they will do it well. The chief point, however, is that the whole of the submarine defences should be under the Admiral, for I do not otherwise see how you are to get an efficient and thorough defence.

Captain W. H. HENDERSON, R.N.: As a naval Officer I entirely agree with the opinions expressed by Captain Colomb and Lieutenant Gladstone. I think it may be safely assumed that a naval attack on one of the fortified ports cannot take place unless the enemy has command of the Channel. It would require an immense amount of preparation, and the putting forth an immense amount of power; for I take it that possession could not be taken without the co-operation of land forces. To succeed would mean the sacrifice of a definite and almost calculable amount of naval strength, which would probably give us the command of the Channel again. I doubt the efficacy of bombardments at long ranges by ships under way (for ships cannot anchor for this purpose if exposed to gun-fire or Whitehead attack) against unseen objects without any knowledge of the damage done: for the short life of breech-loading heavy rifled guns necessitates every shot being carefully husbanded. Continental nations with their large armies would not break their heads against fortified places if the possibility of overrunning the country was open to them. Some remnants of the Fleet would surely have escaped into the ports, and would, in conjunction with those vessels told off for their defence, assist in repelling any naval attack. On the whole, therefore, the sea defence against a sea attack would be naval; unmistakably it should be under one head, and be naval. Sailors would be more in their element opposed to sailors, and up to their ways and means, than soldiers, who would have enough on their hands in looking after the land defences. Besides, if driven off the sea it would be their first interest and duty to defend their own ports and their own ships and stores in those ports from attack. I do not mean that in the first instance this duty should be put on our first line but, as Captain Colomb suggests, on a second line with a distinctly naval organization supplemented by all the naval forces not afloat, and the crews of disabled ships—it must not be forgotten that the corps of R.M.L.I. are trained as gunners as well as the R.M.A. both afloat and ashore. A certain number of ports, naval, commercial, and strategical, must be fortified—it is our duty to keep them sufficiently efficient, not by asking for and wasting large sums of public money in bringing them up every few years to an ideal state, but by yearly devoting sums voted in the current estimates towards slow and sure improvements and additions. Sea defences are distinct from land defences, as is a sea attack from a land attack; modern developments have tended to intensify the difference, and to show that a naval attack can only be met on equal terms by a naval not a military defence.

Colonel SCHAW: I will endeavour very shortly to reply to the remarks that have been made. Sir Edward Hamley was kind enough to make some complimentary remarks, for which I am much obliged to him, but with regard to his very weighty observations on the financial aspect of the question, I should be glad to make it clear that my estimate for the ideal defence of Plymouth was based on the supposition, happily far from the truth, that no defences were in existence there. What is now required to bring existing defences up to date would cost very much less than the sum I named. Sir William Crossman advocates a naval organization for working submarine mines, and several naval Officers have taken the same view. Of course it is a subject which admits of great difference of opinion and much discussion. I have merely put forward the arguments which appear to me to show that it is difficult for the Navy to undertake it. Sir Cooper Key takes the same view as I do, but it must be a subject for decision by superior authority. Sir Cooper Key objected rather to the title of my paper, "Coast Defence," and said as I referred all through

the paper to the defence of harbours, "Coast Defence" was not quite a proper term for it. I admit the criticism, but I did refer to the general defence of our coasts in the beginning of the lecture, and I said I thought it ought to be taken up and reported on by a joint Committee of naval and military Officers, with whom should be associated Officers of the volunteer army. Harbour defence is, however, included in the larger question of coast defence. Captain Colomb rather finds fault with the line I took in thinking it necessary to defend our harbours at all. As I understand him, he thinks the Navy ought to blockade every possible enemy in his own port, and they never ought to be able to come near our ports. Well, I am very thankful to hear that our Navy is so strong that we do not require any defence at all, that we shall be able to shut our enemy's fleet in their own harbours, so that we shall not require any home defence.

Captain COLOMB: What I did say was I did not wish to provide against heavy attacks by fleets, but you are to provide against light attacks.

Colonel SCHAW: But not against the attack of an ironclad fleet. That has not been the general opinion hitherto. It has generally been assumed that it would be possible under certain conditions of a combination of foreign Powers that we might be in such a position that, our own Fleet being absent somewhere else or partly disabled, there might be a heavy attack with ironclads upon one of our ports, and it is looked upon as the duty of the Army that we should give the Navy a strong and certainly secure basis of operations in our military ports. That has been the principle hitherto looked upon as essential for the safety of the country, that military ports should be made secure against any possible attack. If the Navy think that they do not require this secure basis, that of course leads to a different view of the question. As regards the question of howitzer fire, I think Sir Andrew Clarke has answered what Colonel Crawford said, and I need not refer to it.

Colonel CRAWFORD: Will you excuse me? I referred to it as a principle, not with regard to Hong Kong. I referred to the fact of arming coast batteries with howitzers at all, anywhere.

Colonel SCHAW: The subject has been discussed a good deal, and I think the general opinion is that howitzer fire upon ships is very formidable; it prevents them from anchoring certainly. It is not, however, sufficient by itself; it must be combined with direct fire also.

Colonel CRAWFORD: The last thing I think a ship would do would be to anchor or to attempt to anchor.

Colonel SCHAW: I am sorry Sir Andrew Clarke does not agree with my ideal defence of Plymouth. I gave it as illustrating what I believe to be the case still, that we cannot absolutely adhere to any one system of mounting the guns, and we must be prepared to mount guns not only in earthen batteries, but also behind iron where such protection is necessary. I think the case of the cupola or turret which I propose behind the breakwater at Plymouth is one where iron is essential; you cannot get earth here. Picklecombe is also one where an iron casemate would be very advantageous. I quite agree in thinking that wherever you do not want iron protection it is better to have scattered guns, and to mount them behind earth. Lieutenant Gladstone asked me how long it took to lay down the mines at Milford Haven, and how many men were employed. I cannot give the exact number offhand, but I think it took somewhere about three weeks, as well as I remember, and we had two companies of submarine miners employed. That our numbers are not sufficient to lay down all the mines required for the defence of our ports, I quite admit; we require to augment them, and we are doing our best to do it by means of volunteers. He referred to the Whitehead torpedo in submarine batteries. I confess that was an omission from the defensive means described in my lecture. I ought to have referred to them. We have considered them a good deal, but they are not very much in favour with us at present. I think Whiteheads are always more advantageous when used from torpedo-boats than from submarine batteries, but no doubt there are cases where submarine batteries might be used, and the Germans have used them in some cases, I believe. I am reminded by Colonel Armstrong that the defences laid down at Milford were not on the spot, as the regular defences would have been. The regular defences being in store on

the spot would have been laid down much more quickly. These stores were brought from a distance, which naturally took a longer time to lay down than if we had used the stores of the station ready at hand.

The CHAIRMAN: At so late an hour I am sure you will not expect very much from me. The position which I hold as Inspector-General of Fortifications renders it a little difficult for me to criticize either the lecture itself or the discussion which has taken place since. Many points have been raised, and I am quite sure that no one will go away from here without having food for thought with reference to what I may call the present somewhat defenceless state of certain points on our coast. Whether the lecture should have had the name of "Coast Defence" or "The Defence of Coasts" is perhaps a moot point. For my part I think that Colonel Schaw simply meant to direct attention to that which the Navy must sooner or later come back upon, and that is our ports. There can be no question upon this subject, that whether we are to attempt a counter-attack or whether we are to wait for our enemy on our own shores, we must make safe our ports. The defence of our coasts, I quite agree with Captain Colomb, is one of the most important questions of the present day. I think it is one that comes more home to the hearts of Englishmen than perhaps any other, but I look upon it more as a general military question than as one for an Officer of engineers. With regard to organization, no one can doubt that in the present condition of things our ports are not as they ought to be. We have arms, and legs, and feet, but at present we are certainly deficient in the head. Nothing was brought out more clearly at Milford than that point, and I hope that the time is not far distant when those who have been mentioned to suggest some way out of the difficulty will hit upon a happy medium. Whether it is to be done by an artilleryman, an engineer, or a naval man I think matters little. I am quite sure that, whatever may be decided, patriotism and public spirit will do away with friction, and that the branch of the Service who may be for the time delegated to take the command will find that other branches of the Service will be only too glad to subordinate themselves to them. Therefore, although people are making rather a mountain of this, I believe myself it is more of a molehill. Whether the submarine mines are to be taken by the artillery, whether they are to be taken by the Navy, or whether they are to be left with ourselves, is a matter which we can hardly enter upon in this theatre, and therefore that subject, if you will allow me, I shall pass over without remark. Colonel Schaw has drawn attention to the grouping of guns, and the way in which the science of electricity has been brought to bear, so that they can be instantaneously fired upon any given object. I think it is only just to call your attention to another invention of a brother Officer of ours, Major Lothian Scott, who has brought the telescopic sight to such perfection that the artillery, in case of other things failing, would have that to fall back upon, so that all our eggs with regard to the firing of guns would not be in one basket. With regard to what Sir Andrew Clarke has said about iron, I think iron may be a good thing, but I am not one of those who say "there is nothing like leather," applying it to iron. I think that Colonel Schaw is right in his rejoinder that there is a time and place for all things, and that we shall find probably that we cannot do away entirely with iron. We cannot find sites which are always adapted to hydro-pneumatic guns. Sites and places and fixtures for guns must always depend upon station and condition, and I think we may be trusted in the Department to put iron where it is necessary, to use the hydro-pneumatic principle where it is most advantageous, and to put guns of all sorts in different positions with wisdom and due regard to experience. I think, gentlemen, I have nothing more to say except to remind you—and here General Hamley rather took the words out of my mouth—that this is the last time that Colonel Schaw will address us as one of ourselves. I am sure you will join with me in the feeling that one who has spoken to you words of wisdom, and who has addressed you upon many interesting subjects, must not part from us without great regret. Colonel Schaw has been of the greatest use to me, and being of use to me he has been of use to his country. Such a point as that comes well in this theatre, which is made so much use of for national purposes.

SMALL ARMS FOR FIELD ARTILLERY.

By Major J. D. DOUGLAS, R.A.

THE question of arming gunners and drivers with weapons for personal defence has been discussed in various short papers of late in the pages of the "Journal of the Royal Artillery Institution."

I. Seeing how much the safety and unhampered action of field artillery depends on the protection and intelligent support of the other arms, the subject appears to me one which may interest those who support and are supported by artillery as well as those more immediately concerned. For those Officers then whose duties in the field keep them outside the line of guns, I venture to attempt to sketch the state of the case as it is at present, and to give as fair a *résumé* as I can of the various views held on it at present. Restricting the term field artillery to batteries of horse artillery and field batteries, that is excluding batteries of position and mountain batteries, the mounted non-commissioned officers and gunners are armed with cavalry swords, drivers are not armed at all, and all men carried on limbers, carriages, or wagons are practically unarmed.

II. The weapons actually issued to batteries are—

1st. Cavalry swords.—Every gunner of horse artillery has a sword hung to his belt. The preparation for action in the case of all batteries is expressed by the word of command "Off gloves, loop swords." The swords are on this order looped up so as not to interfere with the gunners' movements on foot, and become as useful to them for the time being as their gloves.

2nd. Twelve carbines.—These are securely strapped on the limbers. They are of no use in action, nor are they supposed to be. I disagree with those Officers who would wish to see them taken away, for they are most useful in any semi-hostile country for escorts of foraging parties, as I have seen practically proved.

3rd. Sword-bayonets for gunners of field artillery.—Like the carbines they are carried strapped on the carriages. But unlike the carbines, they are of little or no use when off the carriages. They serve to distinguish the gunner from the driver at church parades! Drivers on foot parades wear spurs and overalls. Roughly speaking, the use of the sword bayonet ceases when swan-neck spurs and foot-straps are discarded.

4th. Last, but very far from least, among the artilleryman's weapons I mention his gun. There are few who would disagree with me in saying that any weapon given him for self-defence which might induce him to desert his gun at a critical moment would defeat its own object. I consider a slung carbine or rifle is a weapon of this nature. Major Ollivant's battery of volunteer horse artillery carried slung rifles in Bechuanaland, but the service they were on was not of

the nature of regular warfare. An anonymous writer in the "Army and Navy Gazette," some twelve or thirteen years ago, advocated the issue of rifles and bayonets to gunners, so carried that the men might form rallying squares if their guns were rushed. Unslinging rifles and fixing bayonets would take up the time in which the last round of case might be fired, which perhaps would leave none of the enemy to carry the battery. It may surprise some to hear that I consider the cavalry sword as at present carried by artillery of the same detrimental character, in a less degree, as the rifle and bayonet. Either swords must be unlooped while the guns are being served, or they will remain in their scabbards, and the wearers be killed while going through the complicated motions necessary to disengage them.

III. The weapon which I, in common with many others, advocate for all ranks, is the pistol. The opponents of the pistol allege, as to gunners, that the gunner should depend on his gun only, and as to drivers that the danger of their making an improper use of firearms is so great as to outweigh the possible advantages of their having means of self-defence. It would appear that their views have at present more weight with the War Office than those of the advocates, and, as the adoption of pistols would entail some extra expense, we can scarcely expect the issue to be made until opinion is almost unanimous as to the necessity for the expenditure.

I scarcely know whether it is a subject for glory or regret that there is probably no Officer of Royal Artillery now serving who has seen horse or field battery guns successfully charged without an escort sufficiently close at hand to shoot down the few men who might get between the guns. I know of one instance, but it scarcely bears on the pistol question. It is the difficulty of getting the practical experiences of eye-witnesses which has induced me to come forward as a theorist. It is worth, I think, inquiring how a battery would behave in the two following cases:—

(a.) A battery in action is charged by lancers. The lancers are good men and the gunners staunch. Some forty lancers only get among the guns. Let Balaclava men say if this is impossible. I believe that with our present equipment the lancers can do what they like. The gunners can get between their wheels, and the lancers can steady their horses and pick them out from their cover like periwinkles. But if the gunners have pistols, the lancers will not steady their horses very easily, and whether the gunners first hit the lancers, or the lancers spear the gunners, would appear very even betting. I fancy the bravest of the enemy only would make an effort at spiking the guns, and the majority would ride on for the unarmed drivers. What would happen would be a question of temperament. Some drivers would dismount between their horses, and the lancers would have their choice of killing the drivers, killing the horses, or drawing their swords and cutting the traces. Other drivers would ride away, limbers and all, in spite of all orders to the contrary, and if the lancers came up with them would, with their whips only for arms, fall an easy prey. One lancer to each team would be sufficient to disable it in either case. If he were the mark for even the worst

aimed fire from three drivers and a gunner, I doubt if he would bring both himself and his horse out of action alive.

(b.) A battery on the move protected by a cavalry escort surprised by a body of cavalry of about the same strength as the escort. The escort charges and drives off the enemy. Only some twenty sabres of the latter, avoiding the shock, ride quietly up to the battery, and proceed to cut traces, spike guns, attack gunners, &c. In a field battery, who is to prevent them; the Officers and some fifteen mounted non-commissioned officers scattered about a long column or line, and fifty unarmed gunners and drivers without a lethal weapon amongst them? They can perhaps frighten the enemy's horses with their helmets and whips, but in what other way they can defend themselves or their guns, I scarcely know.

Both my cases, it will be observed, are taken from cavalry actions, because I think cavalry being unable as a rule to attack the fighting line of infantry will naturally be on the watch for opportunities of attacking artillery on the flanks and in rear. Infantry are scarcely likely to get among guns unless they are in overwhelming numbers; but should a few determined riflemen do so, it is at least as well that the gunners should have the choice of making a fight, rather than be forced to give up themselves and their guns as prisoners and trophies. I only advocate pistols for hand-to-hand fighting. The strongest argument against giving drivers pistols is that they might, by wild shooting, be almost as dangerous to their comrades as to the enemy; and if infantry did get among the guns and horses I have no doubt there would be wild shooting. The British infantry soldier may, or may not, be the coolest of all men in action, but neither trained rifle-shots nor artillery drivers can help their bullets going astray when friends and foes are almost locked in deadly fight. I read, and heard of from eye-witnesses, a case in point which occurred during the somewhat precipitate abandonment of the Hurnai passes during the Afghan War. A mob of unarmed followers were suddenly attacked in a defile by swordsmen of the Marri tribe. The escort of sepoys, who were over and over again a match for the Marris, were paralysed by the fear of shooting more followers than Marris, and the latter were only repulsed after they had cut down and thoroughly broken up the mass of coolies. The Officer commanding the escort may have been right or wrong then in holding back his fire. But if, instead of coolies, he had had to protect guns, gunners, and drivers, unarmed as our men are, he would have had no option but to have shot down, with a contemptible horde of savages, perhaps the equivalent in a general action of a battalion of infantry. I know the ground of which I am writing. A field battery passing through the gorge could be assailed in two ways by swordsmen. The swordsmen if kept at 20 yards distance could hurl down rocks, at the risk, of course, of being shot down easily by the escort, or if they came down hand to hand, they could cut down men and horses as they liked. Twenty reckless men could have stopped a battery, and blocked the road for all wheeled transport in rear of them.

IV. If I have been followed so far, the reader will understand the

want of small or side arms for field artillery, and the reasons I assign for considering the pistol as the proper weapon for both gunners and drivers.

In conclusion, I address a few words on the opinion of those who agree with me that arms are required, but who do not advocate the pistol as the weapon for all ranks. All, or nearly all, put the rifle or carbine aside, and I have only to deal with the advocates of the sword. Its main recommendation is that it cannot injure friends, and it is by some held to be a better defensive weapon than a pistol. In point of fact I believe it to be greatly in the way of a mounted man dismounted, and so embarrassing to limber and other gunners carried on the carriages, that they do not wear swords or sword bayonets. Moreover, although a thrust or blow can be parried, it is only for the horseman that it is a thoroughly good all-round weapon as compared with a pistol. There is, however, a sentiment which I should be the last to under-value, about the queen of weapons: keep it, I say, for mounted men, but hang it to the saddle, so that it may be drawn when wanted, but do not wear it neatly tucked under the waist-belt so that neither friend nor foe can draw it. A gunner's place in the field may be on his horse, on a carriage, or at his gun in action. In the first situation give him a sword by all means. It may be useful and is not in the way. Seated on the carriage he cannot use, or conveniently wear a sword. He may also be better without a pistol, but at least trust him not to fire without very urgent reasons. At his gun his proper work is working the gun, but if the enemy gets the wrong side of the muzzle his safest place is between the wheels. If he has a firearm ready to use from this point of vantage, the chances of his saving his gun and himself are greatly increased, which is about all the advocates of the pistol ask. If a driver has a sword, and is attacked on the off side, he cannot hurt his enemy, nor can the enemy, if similarly armed, hurt him. But he can cut up the off horse and harness as he likes. If a swordsman meets him bridle hand to bridle hand, neither side can do much, but if the enemy be pursuing on the near side of a team, the driver's whip is as useful to him as a sword would be. I have already pictured a driver dismounting between his horses for safety. If he can open fire from this position, his adversary will at least be puzzled how to approach within striking distance of him. Stress has been laid by some writers on the difficulty of teaching drivers to use a pistol when mounted. Shooting from horseback one says is so difficult that it requires a Dr. Carver to be successful. Another says that drivers tired of sitting inactive behind the guns in action would begin to fire and shoot those in front of them. To the first I reply that he exaggerates the difficulty, inasmuch as it is by no means difficult to take a steady aim from a galloping horse at another object moving at the same pace. Many men, far from being Dr. Carvers, have made good shooting in this way to my knowledge at deer, and I believe it is the ordinary recognized method of "hunting" the American buffalo. Of course, a fowling-piece with S.S.G. is a far better weapon for the purpose than a pistol. To the second I

reply that a mounted man if nervous would never fire between his horse's ears, and if he were not very nervous indeed, would not fire his pistol at all while the enemy was in front of the muzzles of the guns, seeing that he is scarcely likely to be himself less than twenty yards from the guns. I cordially agree with those who say that the pistol is almost a useless weapon to absolutely untrained men. I have used the term pistol throughout, as I do not think a revolver is so good a weapon for the purpose as a heavy double-barrelled pistol. Strong and straight for twenty yards should be looked on as the perfection of shooting. I should prefer a spherical bullet and smooth-bore barrel to the most elaborate small-bore rifled revolver.

It is highly probable that if my present (1st Army Corps) battery were sent on service at a week's notice, revolvers would be served out, and I should find myself with a number of delicate and complicated weapons, without practice ammunition, and a lot of men absolutely ignorant of their use. I cannot say personally what I shall do if this happens, but I shall not blame the pistol so much as the system, if I find the weapons the incumbrance which some Officers would consider them.

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THE ENGINEER ARM IN CONTINENTAL ARMIES.

By Capt. W. A. H. HARE, R.E.

FRANCE.

THE FRENCH MILITARY ORGANIZATION.

BEFORE dealing with the French Engineers, it appears desirable to explain the present French military system in its general outline.

The present French military organization provides for an Active Army and a Territorial Army. Briefly, the latter comprises in principle the men that have served in the former. The terms of service, &c., will be given in detail further on (see p. 1190).

THE ACTIVE ARMY.

The Active Army comprises a Standing Army and a Reserve, the men in the latter, with few exceptions, having served in the former.

The Standing Army comprises the troops with the colours in France, Algeria, Tunis, and the Expeditionary Force in Tonquin. With only one very small exception, all military duty in the Colonies is performed by troops belonging to the Ministry of Marine.

The present Standing Army comprises—

Infantry:—

144 Regiments of Infantry of the Line, 30 Battalions of *Chasseurs à pied* or Rifles, 4 Regiments of Zouaves, 4 Regiments of Algerian *Tirailleurs* formerly known as *Turcos*, 2 Regiments of a Foreign Legion, 3 Battalions of African Light Infantry, and 4 Discipline Companies.¹

The Zouaves, *Tirailleurs*, Foreigners, Light Infantry, and Discipline Companies are for service in Algeria and Tunis. Of these the *Tirailleurs* are natives of Africa.

A Regiment of the Line or Zouaves consists of 4 Battalions of 4 Companies each and two *Depôt* Companies, and a Battalion of *Chasseurs* of 4 Companies and a *Depôt* Company. A Regiment of *Tirailleurs* or Foreigners consists of

¹ There is a fifth discipline company, but it is unarmed and called a company of pioneers.

4 Battalions of 4 Companies each and a *Depôt* Company, and a Battalion of Light Infantry of 6 Companies.

The 4 Battalions of a Regiment of the Line comprise 3 so-called "Active" (or Field) Battalions, and a 4th or "Disponible" or "Fortress" Battalion.

Cavalry :—

12 Regiments of Cuirassiers, 26 Regiments of Dragoons, 12 Regiments of Hussars, 20 Regiments of *Chasseurs à cheval*, 4 Regiments of *Chasseurs d'Afrique*, 3 Regiments of *Spahis*, and 8 Remount Companies.

The *Chasseurs d'Afrique* and *Spahis* are for service in Algeria and Tunis. The latter are natives of Africa.

The Regiments are all of 5 Squadrons, except the Regiments of *Chasseurs d'Afrique* and *Spahis*, which are of 6. Of the 5 Squadrons, 4 are Field Squadrons and one is a *Depôt* Squadron.

Artillery :—

38 Regiments of Field Artillery, 16 Battalions of Garrison Artillery, 2 Regiments of Pontoneers, and 13 Companies of Workmen and Artificers.

The Regiments of Field Artillery are all grouped in Brigades of 2 Regiments each, one having 12 Field Batteries, and the other 8 Field and 3 Horse Artillery Batteries. 3 Field Batteries stationed in the Alps and 2 in Tonquin¹ have mountain equipment. There are besides, 9 extra Field Batteries for service in Algeria, of which 3 have mountain equipment, and 3 extra Batteries in Tonquin, 1 having mountain equipment. The total strength of the Field Artillery is then 440 Field and Horse Artillery Batteries and 9 Mountain Batteries. The Batteries are of 6 guns each in peace or war.

A Battalion of Garrison Artillery consists of 6 Batteries.

The Regiments of Pontoneers are of 14 Companies each.

Engineers :—

4 Regiments of 5 Battalions of 4 Companies of Sappers and Miners, a *Depôt* Company, a Railway Company, and a Train Company each. One Battalion of Sappers and Miners has recently been converted into a Railway Battalion.

Train :—

20 Squadrons of 8 Companies each, besides 16 Special Companies for Service in Algeria, Tunis, and Tonquin.

Gendarmerie :—

The Gendarmerie were reorganized by a Decree of last April (1886). The new organization is 18 Legions for the 18 Army Corps Districts, a Legion for the Military Government of Paris, a special Legion for Corsica, and a Legion for Algeria. The Republican Guard and the Colonial and Coast Gendarmerie remain as before. The Republican Guard is a special corps of 3 Battalions of 8 Companies each, and 8 Squadrons. Its expenses are borne half by the City of Paris and half by the War Ministry. The Colonial and Coast Gendarmerie comprise 4 and 5 Companies respectively. They are under the Ministry of Marine.

Companies are divided into Brigades, mounted and dismounted. According to the old organization, there were 2,385 of the former, and 1,932 of the latter in France and Algeria. The number of Companies in a Legion varies.

The French Gendarmerie, though performing certain civil police duties in peace, is a strictly military Corps, and enters into the composition of both Active and Territorial Armies.

PEACE STRENGTHS (*Effectifs Budgétaires*).

The Peace Establishment of the French Army is fixed by Law at 523,833 of all ranks, with 131,385 horses. Of the former, 26,974 are Officers, and the

¹ All references to the Expeditionary Force in Tonquin refer to the commencement of the present year (1886).

remainder, or 496,859, non-commissioned officers and men. 2·5 per cent. of the Officers, and 8·2 per cent. of the non-commissioned officers and men are reckoned on as non-effective or absent for various reasons, which reduces the actual Peace Strength to 26,341 of the former, and 456,727 of the latter, or 483,038 of all ranks.

At the commencement of the present year, of the 26,974 Officers, 23,233 were in France, 2,362 in Algeria, 645 in Tunis, 700 in Annam and Tonquin, 22 (Gendarmerie) in various Colonies, 9 (Spahis) in Senegal, and 3 (Veterinary Surgeons), attached to the Marine Artillery. Of the 496,859 non-commissioned officers and men, 407,585 were in France, 49,509 in Algeria, 15,086 in Tunis, 24,000 in Annam and Tonquin, 751 (Gendarmerie) in various Colonies, and 178 (Spahis) in Senegal. Of the horses, 110,808 were in France, 15,797 in Algeria, 4,482 in Tunis, 100 in various Colonies, 190 (Spahis) in Senegal, and 3 attached to the Marine Artillery.

The Peace Establishments of the various Arms, &c., are as follows :—

| | Officers. | N.C. officers and men. | Total all ranks. | Horses. |
|-------------------|-----------|---------------------------|---------------------|---------|
| Infantry | 12,100 | 294,927 | 307,027 | 6,565 |
| Cavalry | 3,621 | 65,676 | 69,297 | 63,193 |
| Artillery | 3,369 | 68,240 | 71,609 | 31,818 |
| Engineers | 914 | 10,502 | 11,416 | 1,007 |
| Train | 412 | 11,428 | 11,840 | 9,954 |
| Gendarmerie | 787 | 25,048 | 25,835 | 13,152 |

Deducting 2·5 per cent. in the case of the Officers, and 8·2 per cent. in the case of the non-commissioned officers and men, gives the actual strength with the colours in any of these cases.

RECRUITING.

The French Army is recruited partly by the conscription and partly by voluntary enlistment, but mainly of course by the former.

The French conscript is taken nominally on the 1st July of the year in which he completes his 21st year, but does not join in practice till early in the following December. In Algeria he is taken nominally on the 1st April of the same year, but really on the 1st of the following September.

The annual contingent is divided into two portions by lot, the first being taken for a nominal service of five years, and the second for a nominal service of one year, with the colours.

The terms of service for the first portion for France and Corsica, are 5 years with the colours and 4 years in the Reserve of the Active Army, followed by 5 years in the Territorial Army, and 6 years in the Reserve of the Territorial Army.

In the case of the second portion of the French and Corsican Contingent and the whole Contingent (French) of Algeria,¹ the men pass into the Reserve after one year's service with the colours, and remain in it for eight years. In other respects the terms of service are the same.

As a matter of fact, the 5 years' service with the colours means 46 months

¹ Algeria is the only French Colony in which Frenchmen are liable to compulsory military service.

at the outside instead of 60, and the 1 year's service 10 months instead of 12. In reality it is less.

Volunteers or enlisted men are of two kinds, viz., men enlisted for five years with the colours, and one-year Volunteers—a copy of the German institution. An advantage given to Volunteers is that they are taken much younger than conscripts.

The population of France and Corsica may be taken at 38,000,000, and the number of young men that figure in the beginning of January as having completed their 20th year in the preceding year, at some 312,000, or roughly, about 8 per 1,000 of the total population. Of these, some 47,000 may be said to be totally unfit for military service of any kind. Deducting these, exemptions, recruits for the Navy, &c., the Standing Army is supposed to take annually some 156,142 recruits; of these, 138,751 are conscripts, 12,807 five-year volunteers, and 4,584 one-year volunteers.

Of the conscripts, 96,727 are nominally taken for five years' and 40,724 nominally for one year's service with the colours, besides 1,300 for the latter period in Algeria, out of the 2,600 young Frenchmen annually available for military service in that Colony.

We have seen that the Peace Strength is fixed by Law at 523,833 of all ranks. But of these there is a permanent portion comprising—

26,974 Officers.

25,048 Gendarmes.

15,879 Re-engaged men.

5,214 Foreigners.

11,885 Algerines and Tunisians.

5,087 *Disciplinaires*, or men undergoing punishment service.

Total 90,087 of all ranks.

Deducting these and the year's contingent of recruits, together 246,229, from the Peace Strength, there remain but 277,604 for the remainder, or men nominally called upon to serve for four years more with the colours. Now the annual contingent of such men, it has been shown, amounts to 109,534, and three such contingents would, deducting casualties,¹ amount to 307,111, so that four years' service with the colours is out of the question, and an average of a little over three much nearer the actual truth.

To make the two ends—the Budget and the Peace Strength—meet, recourse is had to furloughs on a large scale, and renewed from time to time (*congé renouvelable*).

The number of men annually enlisted for the Foreign Legion is 2,920, and for the Algerian and Tunisian troops 1,655. The latter receive a bounty of 400 fr. (16*l.*).

The terms of service are the same for all arms except the Cavalry and Railway Companies of the Engineers. These take no men of the second portion of the contingent.

France, including Corsica, but with the exception of the department of the Seine, the department of the Seine-et-Oise, and the City of Lyons with four cantons of the department of the Rhone (Neuville, Givors, Villeurbanne, and Saint Genis-Laval), is divided into 18 Army Corps Districts or *régions*, and these again into 144 Sub-districts or *Subdivisions de région*. In each of these there is a Recruiting Centre or Office, or *Bureau de Recrutement*.

To this Bureau belong all men liable to military service in the Sub-district except men belonging to arms other than the Infantry of the Territorial

¹ French military statistics show that a contingent loses 4 per cent. of its strength after a year's service, 3 per cent. after 2 years' service, and 2 per cent. after every additional year's service.

Army. These belong to a special Bureau at the Headquarters of the District itself.

Besides these 144 Recruiting Offices, there are 9 others in France, and 3 in Algeria. These are:—1 additional office at Digne in the Aix Sub-district, 1 at Lyons for the City of Lyons and the cantons already alluded to, 1 at Versailles for the department of the Seine-et-Oise, and 6 in Paris for the department of the Seine. The 3 offices in Algeria are at Algiers, Oran, and Constantine respectively.

The total number of Recruiting Offices in France and Algeria is then 156.

The French Army, for reasons chiefly political in their nature, is not territorially recruited. Both conscripts and enlisted men for five years' service are invariably sent to serve in Corps and Regiments at a considerable distance from the Sub-district they are raised in. Only men called upon to serve for a year may be said to be in any way territorially recruited, that is to say, are posted to Corps and Regiments the dépôts of which are in or near the Sub-districts they come from.

On the other hand, the Reserve of the Active Army and the Territorial Army are "territorial," or as the French call it *régional*, all men *en disponibilité*, in the Reserve, and in the Territorial Army with its Reserve, joining, with few exceptions, in case of mobilization, the Corps and Regiments of their respective arms that happen to be in their Sub-districts.

Thus, only in the case of those who had served ten months or so with the colours, would Reserve men *ever rejoin, except as an accident, the Regiment they had served in.*

Conscripts taken in Algeria are sent to serve their year's service in the South of France, if born in Algeria, but if born in France, are posted to Corps and Regiments in the Colony.

In the case of the Engineers, the men of the first portion are chosen from the whole contingent throughout France, and distributed to the four Regiments. The men of the second portion are taken from four groups of Sub-districts, roughly representing the four quarters of France. The men for the Railway Companies are taken from the contingent throughout the country.

Thus, without going any further, the French system of recruiting and mobilization may be seen at a glance to be wanting in the very first principle which governs the German—the mainspring in fact of the whole machine of which it is a copy.

TERRITORIAL ORGANIZATION.

France, including Corsica, is divided into 18 Army Corps District Commands and two Military Governments of Paris and Lyons. Each Army Corps District is again divided into 8 Sub-district Commands.

In each Army Corps District are supposed to be quartered, in theory, the troops which, when mobilized, would form a complete Army Corps, besides other troops such as Cavalry, Garrison Artillery, &c., not forming part of Army Corps.

The former, or the troops forming part of the Army Corps, are briefly: 2 Divisions of Infantry, a Battalion of Chasseurs, a Brigade of Cavalry, a Brigade of Artillery, a Battalion of Engineers, a Squadron of Train, and a Legion of Gendarmerie, besides non-combatants or Administrative Services.

But these are by no means always to be found quartered in their respective Army Corps Districts. The Dépôts of Infantry and Cavalry Regiments and Chasseur Battalions always remain in their proper Sub-districts no matter where the Regiments or Battalions may be. The Artillery Brigades remain with certain small detachments in their own Districts, with the exception of the Artillery Brigade of the Algerian Army Corps which is stationed at Vincennes. But the Engineer Battalions and Pontoneer Regiments have

practically no connection in peace with Army Corps, as will be seen further on. Of the two *Dépôt* Companies of a Zouave Regiment, one is quartered in Algeria and the other in the South of France.

The two Infantry Divisions of an Army Corps should always comprise 24 Field Battalions of Infantry of the Line. But this is, at present at any rate, not the case, the numbers varying from 12 to 30. Again, the Military Government of Paris borrows its three Infantry Divisions, so to speak, from three separate Army Corps, and that of Lyons its Infantry Division and Brigade from two Army Corps, and one Brigade in the South of France sends its Regiment alternately for service in Corsica. All these troops are changed every three years.

The 4th Battalions of Infantry Regiments are, many of them, detached from the Regiments they belong to, 17 at the beginning of the present year being in Algeria and Tunis, and 3 in Tonquin. Of the Chasseurs à pied only 12 were in their proper Districts, 5 being in Algeria and Tunis, and 1 in Tonquin. Of the 12 Battalions not belonging to Army Corps, 8 were stationed near the German frontier and 4 near the Italian frontier. The Cavalry Brigades were all in their respective Districts except one. The Engineer Battalions are all with the Headquarters of the four Engineer Regiments with certain detachments, and only *three* Engineer Battalions are actually in the Districts of the Army Corps to which they would belong, on mobilization. The Squadrons of Train and Legions of Gendarmerie are in their proper Districts. The two Regiments of Pontoneers are entirely stationed, with one detachment, in two Army Corps Districts.

All troops in an Army Corps District or Military Government are under the General Commanding it. As a rule the troops in the Sub-district Commands corresponding to the four Infantry Regiments of a Division are under the General Commanding that Division, and the troops in the two Sub-districts corresponding to the two Infantry Regiments of a Brigade are under the General Commanding that Brigade. There are, however, a good many exceptions to this rule—at the beginning of the present year in eight Districts. As regards Paris, the troops in the Department of the Seine are under the General Commanding the City of Paris, and those in the Seine-et-Oise under the General Commanding that Department. The troops in the Department of the Rhone are under the General Commanding the City of Lyons.

In each District there is a complete Permanent Staff divided into an Active Section and a Territorial Section. The former would take the field with the General. The latter would remain behind, at any rate at the outset of hostilities, under a General that would be specially appointed at the time.

The numbering of the Infantry Divisions and Brigades is the same as in the Prussian Service, that is to say, the 1st and 2nd Divisions belong to the 1st Army Corps, and the 1st and 2nd Brigades to the 1st Division, and so on. The Cavalry and Artillery Brigades, the Engineer Battalion, the Train Squadron, the Gendarmerie Legion, and the various Sections of Medical, Administrative, and Supply Sections, all bear the number of the Army Corps. The Regiments of Infantry and Cavalry and Battalions of Chasseurs are independently numbered. The Cavalry not required for the Army Corps Brigades are organized in independent Brigades and Divisions.

The Army Corps are known by the Roman numbers I to XVIII.

Besides these there is a special Army Corps, the XIXth, for Algeria. It is organized in three Divisions, not numbered, but known as those of Algiers, Oran, and Constantine. It comprises the special troops already alluded to and certain detachments from the Army in France and Corsica.

At the beginning of the present year there were of the latter, 10 Battalions

of Infantry of the Line (*disponibles*, or 4th) 3 Battalions of Chasseurs, 2 Regiments of Hussars, 6 detached Squadrons of Chasseurs à cheval, 9 detached Batteries of Field Artillery, a detached Company of Pontoneers, 3 detached Companies of Engineers, and 10 detached Companies of Train.

The 12th Brigade of Artillery, the 19th Battalion of Engineers, and the 19th Squadron of Train are in France.

The 19th Legion of Gendarmerie is in the Colony.

Besides the XIXth Army Corps and Military Governments, there remain the Division in Tunis and the Expeditionary Force in Tonquin.

The former is made up of detachments from the XIXth Army Corps and from France. It is organized in three Subdivisions under Brigadier-Generals, and comprised, at the beginning of the year, a Regiment of Zouaves, a Regiment of Algerian Tirailleurs, a Discipline Company, a Regiment of Chasseurs d'Afrique, and 3 squadrons of Spahis, belonging to the XIXth Army Corps; besides 7 Battalions (*disponibles*) of Infantry of the Line, 2 detached Battalions of Chasseurs, 2 detached Squadrons of Hussars, 3 detached Batteries of Artillery, 1 detached Battery of Garrison Artillery, a detached Company of Engineers, 4 detached Companies of Train, and detachments of medical, administrative, and supply services, from France and Corsica.

At the commencement of the present year the force in Tonquin comprised 3 Battalions (*disponibles*) of Infantry of the Line, 1 Battalion of Chasseurs, 3 Battalions of Zouaves, 2 Battalions of African Light Infantry, 4 Battalions of the Foreign Legion, 4 Battalions of Algerian Tirailleurs, a Squadron of Chasseurs d'Afrique, 3 Squadrons of Spahis, 10 batteries of Artillery, and 2 Companies of Engineers, besides detachments of Train, &c. This, of course, excludes troops of the Marine Infantry and Artillery, which belong to the Admiralty.

The only other detachment (if we exclude Gendarmerie) furnished by the Army for duty in the Colonies is at present a Squadron of Spahis for duty in Senegal, styled *Escadron de Spahis Sénégalais*.

All other military duty in the Colonies is undertaken by the Marine Infantry, Artillery, &c. These troops do not do duty on board ship, however, like our Marines.

The above is a rough outline of the present organization of the Active Army. It is especially interesting, taken as it is at the beginning of the present year, as showing how difficult a military system copied from the German, and intended for national defence, can be made to agree with an aggressive Colonial policy.

TERRITORIAL ARMY.

The following is a brief description of the organization, in theory at any rate, of the French Territorial Army.

Infantry :—

144 Regiments corresponding to the 144 sub-districts, or 8 Regiments per Army Corps. Each Regiment is of 3 Battalions of 4 Companies each, and a dépôt Company. The cadres are laid down as the same as for the Active Army, except that a Regiment would be commanded by a Lieutenant-Colonel. In the Sub-district of Aix, in the XVth Army Corps District, there is a second Regiment. Thus the total paper strength is 145 Regiments, or 435 Battalions. There are also 9 Territorial Battalions of Zouaves, bringing the total number of Battalions of Infantry up to 444, with 154 dépôt Companies.

The Infantry Regiments are numbered consecutively throughout the 18 Army Corps Districts, Nos. 1 to 8 belonging to the Ist Army Corps District, 9 to 16 to the IIInd Army Corps District, and so on.

Cavalry :—

8 Squadrons to each Army Corps District, besides 4 Territorial Squadrons of Chasseurs d'Afrique, or 148 Squadrons in all.

Artillery :—

1 Territorial Regiment to each Army Corps District bearing its number. The number of batteries in a Regiment varies according to circumstances from 8 to 30. There are 13 Territorial batteries in Algeria and 6 local batteries in the 1st Army Corps District, bringing the total number of batteries up to 287.

Engineers :—

18 Battalions of Engineers, or 1 to each Army Corps District, bearing its number. The number of Companies varies according to circumstances, at present from 2 to 9, giving 61 in all. There are 4 Territorial dépôts for these Battalions, one at each of the Schools of Military Engineering.

TRAINING OF THE RESERVES AND TERRITORIAL ARMY.

Two entire classes of the Reserve of the Standing Army are annually called out for training during the period of the Autumn Manœuvres, in the case of the infantry, engineers, garrison artillery, pontoneers, and Railway Companies. The classes are—the one about to pass into the Territorial Army, and the next behind it but one. In the case of the cavalry and field artillery the oldest of these classes is called out for the manœuvre period, but the other for a period after the manœuvres, or from the 25th September to the 12th October. The Reserve men of the Gendarmerie are only kept for ten days, viz., from the 1st to the 10th September; the Reserve men of the Train, &c., are called out at various periods, according to orders from the War Ministry.

The men of the Territorial Army are only called out for a period of thirteen days' training, including the day of arrival and departure, during the five years they figure in it. The classes are each called out for two consecutive years, half at a time. Thus in 1886 and 1887 half of the 1874 and 1875 classes would be called out together, in 1888 and 1889 half of the classes of 1876 and 1877, and so on.

The training takes place at two periods of the year, viz., in the spring and autumn. The spring training takes place in the end of April and beginning of May, and the autumn training in October. Infantry, artillery, engineers, and Gendarmerie are called out in the spring, and cavalry in the autumn. Train, &c., are called out at various periods, according to orders issued on the subject by the War Ministry.

The training of the Engineers of the Territorial Army takes place at the four Schools of Military Engineering.

Officers of the Territorial Army are called out for training nominally every two years for a period of fourteen days at a time, but Officers of the Engineer Staff of the Territorial Army only by special Ministerial order.

THE PEACE DISTRIBUTION OF THE STANDING ARMY.

The distribution of the Standing Army in the beginning of the present year (1886) is given in the accompanying table.

THE ENGINEERS OF THE FRENCH ARMY.

Introductory.

The Engineers in the French Army are known as the *Corps du Génie*, with military men simply as *le Génie*, or generally as *le Génie Militaire*, to distinguish it from *le Génie Civil* or Civil Engineers. The term *Ingénieur* is never applied to Engineer Officers.

The French Engineers comprise a certain number of General Officers shown

ing of the present Year (1886).

| Infantry. | | | Artillery. | | | | | Engineers. | | | | | | |
|---------------------------------|--------------------|--------------------|------------------|----------------------------|---------------------|---------------------|----------------------|-------------------|--------------------|------------------|------------------|------------------|----------------------|-----------------------|
| Squadrons, Chasseurs d'Afrique. | Squadrons, Spahis. | Remount companies. | Field batteries. | Horse artillery batteries. | Mountain batteries. | Garrison batteries. | Pontooner companies. | Sapper companies. | Railway companies. | Train companies. | Depôt companies. | Train companies. | Gendarmerie legions. | Discipline companies. |
| .. | .. | .. | 19 | 2 | .. | 9 | .. | 16 | .. | 1 | 1 | 3 | 1 | — |
| .. | .. | .. | 20 | 2 | .. | 3 | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | 1 | 20 | 3 | .. | 1 | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | .. | 20 | 2 | .. | .. | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | .. | 20 | 5 | .. | .. | .. | 1 | .. | .. | .. | 3 | 1 | — |
| .. | .. | .. | 26 | 8 | .. | 30 | .. | 4 | .. | .. | .. | 3 | 1 | — |
| .. | .. | .. | 19 | 3 | .. | 14 | .. | 3 | .. | .. | .. | 3 | 2 | — |
| .. | .. | 1 | 20 | 2 | .. | 2 | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | 1 | 19 | 3 | .. | .. | 14 | .. | .. | .. | .. | 3 | 2 | — |
| .. | .. | .. | 20 | 2 | .. | 4 | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | 1 | 19 | 2 | .. | 3 | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | .. | 20 | 2 | .. | .. | .. | .. | .. | .. | .. | 3 | 2 | — |
| .. | .. | .. | 20 | 2 | .. | .. | .. | .. | .. | .. | .. | 3 | 1 | — |
| .. | .. | .. | 20 | 2 | .. | .. | .. | .. | .. | .. | .. | 3 | 2 | — |
| .. | .. | .. | 18 | 4 | 3 | 10 | .. | 16 | .. | 1 | 1 | 3 | 2 | — |
| .. | .. | .. | 20 | 3 | .. | 1 | 13 | 3 | .. | .. | .. | 3 | 3 | — |
| .. | .. | .. | 16 | 2 | .. | 2 | .. | 16 | .. | 1 | 1 | 3 | 2 | — |
| .. | .. | .. | 19 | 3 | .. | .. | .. | .. | .. | .. | .. | 3 | 2 | — |
| .. | .. | 1 | 17 | 3 | .. | 3 | .. | .. | .. | .. | .. | 3 | 2 | — |
| .. | .. | .. | 14 | 4 | .. | 7 | .. | 12 | 8 | 1 | 1 | 6 | 1 | — |
| } 23 | 14 | 3 | { 6 | .. | 3 | .. | 1 | 3 | .. | .. | .. | 9 | 1 | 3 |
| | | | | .. | .. | .. | 1 | 1 | .. | .. | .. | 4 | .. | 1 |
| | | | | 9 | 3 | .. | .. | 1 | .. | .. | .. | 3 | — | — |
| .. | 1 | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 24 | 18 | 8 | 384 | 57 | 9 | 90 | 28 | 76 | 8 | 4 | 4 | 76 | 31 | 4 |

Table showing the Distribution of the Standing Army in the beginning of the present Year (1886).

| Command and headquarters. | Infantry. | | | | | | | | | | | Cavalry. | | | | | Artillery. | | | | Engineers. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | Regiments of the line. | | | Chas-seurs à pied. | | Regi-ments of Zouaves. | | Regi-ments of Tirail-leurs. | | Foreign legion. | | Field squadrons. | Squadrons, Chasseurs d'Afrique. | Squadrons, Spahis. | Remount companies. | Field batteries. | Horse artillery batteries. | Mountain batteries. | Garrison batteries. | Pontoneer companies. | Sapper companies. | Railway companies. | Train companies. | Depôt companies. | | | | Train companies. | Gendarmier legions. | Discipline companies. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Full battalions. | Disponible or fortress battalions. | Depôt companies. | Battalions. | Depôt companies. | Battalions. | Depôt companies. | Battalions. | Depôt companies. | Battalions. | Depôt companies. | | | | | | | | | | | | | | | | | | | | Army Corps. | Independent. | Depôt squadrons. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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on the same general list of General Officers (known as the *Etat Major-Général de l'Armée*), much the same as with us, a Corps of Field Officers, Captains, and Subalterns, and 4 Regiments of Engineers officered from this Corps.

Field and other Officers of Engineers not belonging to these Regiments constitute what is called the "Engineer Staff," or *Etat Major particulier du Génie*, to which belong, in addition, a certain number of *employés* known as *Adjoints du Génie*, corresponding somewhat to our clerks or foremen of works. They are appointed from non-commissioned officers of Engineers. To the Engineer Staff also belong a few *employés*, known as *ouvriers d'Etat*, or foremen of works, and a variable number of *stagiaires* or non-commissioned officers of Engineers—probationary *Adjoints du Génie*—besides certain *employés* known as *portiers consignes* or barrack sergeants. Of these the names of the *Adjoints du Génie* alone are given in the *Annuaire* or Army List.

PART I.—OFFICERS.

Numbers and Establishment.

The French *Etat Major-Général de l'Armée*, or List of General Officers, comprises—

- Field-Marshals (*Maréchaux de France*).
- Divisional Generals (*Généraux de Division*).
- Brigadier-Generals (*Généraux de Brigade*).

According to the Law of the 4th August, 1839, the number of Field-Marshals was limited to six in peace, but might be exceeded in war. By the Law of the 13th March, 1875, appointment to the rank of Field-Marshal can only be made by passing a special Act for the purpose, so that for the time being the rank is virtually abolished.

At the beginning of the present year there were only three Field-Marshals—all unemployed—the well-known French Generals Canrobert, MacMahon, and Lebœuf.

General Officers are by the Law of the 13th March, 1875 (Art. 8), now classed in two sections, the first comprising General Officers on the active list employed and unemployed, or *en activité et disponibilité*, and the second General Officers on the Reserve List.

The establishment of the first is fixed at—

- 100 Divisional Generals.
- 200 Brigadier-Generals.

Divisional Generals who have distinguished themselves on active service may be retained in the first Section till 70 years of age.

The second Section comprises Divisional Generals over 65, and Brigadier-Generals over 62 years of age. It also comprises certain General Officers temporarily unfit for service for medical reasons. These may be called upon to serve when such reasons cease to exist, provided, of course, they are within the limits of age.

Promotion to the rank of Brigadier and Divisional General is made by selection. A Colonel to be promoted to the former rank must have at least three years' service in his rank. Selection lies with the Committee on Promotion at the War Ministry, or the *Commission de Classement*.

According to the *Etat du Corps du Génie* for 1885, there were in the first Section of the list of General Officers nine Divisional Generals of Engineers, or *Officiers Généraux provenant du Corps du Génie*. Two of these were retained in the first Section for distinguished services, viz., Faidherbe and Farre, both Senators, but unemployed. The remaining 6 were all employed, viz., 1 as

President of the Committee on Fortifications; 1 as member of the same; 1 as Commanding Engineer of the Military Government of Paris; 1 as a member of the Committee on Artillery; 1 as a member of the mixed Committee on Public Works, and 2 as commanding Infantry Divisions.

There were 22 Brigadier-Generals in the first Section. Of these, 21 were employed in a military capacity, viz., 1 as Commanding Engineer in Algeria; 1 as Commandant of the Practical School for Artillery and Engineers at Fontainebleau; 1 as Engineer Director at Paris; 1 as Assistant Chief of the General Staff at the War Ministry; 1 as commanding a Brigade in Tonquin; 1 as Chief of the General Staff of an Army Corps; 1 as commanding a Cavalry Brigade; 1 as commanding a Sub-district of an Army Corps District; 2 as commanding Infantry Brigades; 3 as members of the Committee on Fortifications; and 8 as Commanding Engineers of Army Corps Districts. One was shown as a *Conseiller d'Etat en Service Ordinaire*, or in civil employ.

There were no Divisional but 2 Brigadier-Generals in the 2nd or Reserve Section.

There were 7 Divisional and 25 Brigadier-Generals on the Retired List (*en retraite*). Two of these were Senators.

The establishment of the Corps is, by the Law of the 13th March, 1875, fixed as follows:—

Engineer Staff (Etat Major particulier du Génie)—

(a.) *Officers*:—

| | | | |
|-----|--|---|------|
| 33 | Colonels. | | |
| 33 | Lieutenants-Colonels. | | |
| 124 | <i>Chefs de bataillon</i> . | | |
| 148 | First Captains (<i>Capitaines de 1e Classe</i>). | | |
| 148 | Second | ” | 2e ” |

Total 486 of all ranks.

(b.) *Adjoins du Génie*:—

| | | | |
|-----|--|----|------|
| 20 | <i>Adjoins principaux de 1e Classe</i> . | | |
| 100 | ” | ” | 2e ” |
| 100 | <i>Adjoins de 1e Classe</i> . | | |
| 150 | ” | 2e | ” |
| 200 | ” | 3e | ” |

Total 570 of all ranks.

Engineer Regiments—

| | |
|----|--|
| 4 | Colonels. |
| 4 | Lieutenant-Colonels. |
| 24 | <i>Chefs de bataillon</i> and Majors. |
| 4 | <i>Officiers d'habillement</i> (Captains). |
| 4 | Paymasters (Captains). |
| 4 | Ensigns (2nd or Sub-Lieutenants). |
| 4 | Assistant Paymasters (Subalterns). |
| 92 | First Captains commanding Companies or <i>Capitaines Commandants</i> . |
| 98 | Second Captains of Companies or <i>Capitaines en 2d</i> . |
| 92 | First Lieutenants or <i>Lieutenants en 1er</i> . |
| 92 | Second Lieutenants or <i>Lieutenants en 2d</i> . |

Total 422 of all ranks.

There are besides a certain number of Sub-Lieutenants not fixed by estab-

lishment. Of these, the majority are studying at the Practical School at Fontainebleau, and these are shown as belonging to the Engineer Staff; the remainder belong to the Engineer Regiment. Of the former there were 101, and of the latter 30, shown in the *Etat du Corps du Génie* for 1885.

The total fixed establishment of the Corps is therefore 898 Officers and 570 *Adjoints du Génie*.

The total establishment according to the Budget for the present year is 914 Officers and 10,502 non-commissioned officers and men, with 1,007 horses.

Above the rank of First Lieutenant all Engineer Officers are equally available for duty with the Engineer Staff or Regiments.

Adjoints du Génie belong to the category of commissioned Officers, and their names figure in the Army List. They are a military body sworn to allegiance (*un corps assermenté*). They have Officer's rank but not Officers' titles.

Besides the *Adjoints du Génie*, the Engineer Staff comprises a variable number of non-commissioned officers attached to it, qualifying for *Adjoints du Génie* of the 3rd Class. They are styled *sous-officiers stagiaires*, and are supernumerary to the Regiments they belong to. If after their probationary service they are found unfit for *Adjoints du Génie*, they revert to their Regiments.

The Engineer Staff also comprises another kind of *employé*, styled *ouvrier d'Etat* or foreman of works, but they do not hold Officer's rank. There are only six of these, they are all employed at the four Schools of Military Engineering. They are appointed from non-commissioned officers.

Barrack sergeants or *portiers consignés* also belong to the Engineer Staff. The establishment of these is fixed at—

| | | | | |
|---|---|---|----|---|
| 130 <i>Portiers Consignés de 1e Classe.</i> | | | | |
| 90 | „ | „ | 2e | „ |
| 72 | „ | „ | 3e | „ |

Total 292

The *Etat du Corps du Génie* for 1885 gives a list of—

| | | | | |
|--|---|----|---|---|
| 36 Colonels and 3 <i>hors cadre</i> or Supernumerary. | | | | |
| 36 Lieutenant-Colonels and 4 <i>hors cadre</i> or Supernumerary. | | | | |
| 148 <i>Chefs de Bataillon</i> | „ | 11 | „ | „ |
| 239 First Captains | „ | 8 | „ | „ |
| 204 Second Captains | „ | 1 | „ | „ |
| 93 First Lieutenants. | | | | |
| 44 Second Lieutenants. | | | | |
| 131 Sub-Lieutenants. | | | | |

Or a total of 931 of all ranks.

The *Liste d'Ancienneté* in the Army List for the same year differs slightly from this, the numbers borne on the strength of the Corps being 37 Colonels, 37 Lieutenant-Colonels, 147 *Chefs de Bataillon*, 224 First Captains, 225 Second Captains, 72 First Lieutenants, 65 Second Lieutenants, and 132 Sub-Lieutenants, or a total of 939 of all ranks.

Of the Officers Supernumerary, 1 Colonel was President of a mixed Commission at the War Ministry, 1 Lieutenant-Colonel on special duty in Turkey, and 1 *Chef de Bataillon* in the Recruiting Department; the remainder were on the General Staff.

There were besides the following on special duty, but not shown as supernumerary :—

1 Colonel and 2 *Chefs de Bataillon* as Military Attachés to Embassies abroad, and 1 *Chef de Bataillon* on special duty in Morocco.

1 Colonel commanding a Sub-district in Algeria.

18 First and Second Lieutenants employed as aides-de-camp and *Officiers d'Ordonnance* to General Officers.

8 First and Second Captains studying at the Staff College.

2 Brigadier-Generals employed on the *Conseil d'Etat*.

1 Brigadier-General, 3 Lieutenant-Colonels, 8 *Chefs de Bataillon*, 20 Captains, and 2 Lieutenants, employed in training and educational establishments other than the four Schools of Military Engineering, but of these 1 *Chef de Bataillon* and 3 Captains were on the Retired List.

1 retired Colonel and 1 *Chef de Bataillon* employed under the Ministry for Public Works, and 1 *Chef de Bataillon* under the Ministry of the Interior.

There were altogether 31 Officers of various ranks on the General Staff, and 5 *Chefs de Bataillon* and 18 Captains shown as *brevetés*, or as having passed the Staff College.

5 Colonels, 1 Lieutenant-Colonel, 7 *Chefs de Bataillon*, and 5 First Captains, were ex-Officers of the Staff Corps broken up in 1880. Of these, only 3 originally came from the *Ecole Polytechnique*, the remainder having been students at the School of St. Cyr (see p. 1196).

The Reserve List of the Active Army comprises—

Captains.—1 pensioned Captain of Engineers, and 33 2nd Class Government Civil Engineers ranking as Captains.

Lieutenants.—4 retired Lieutenants of Engineers, and 68 3rd Class Government Civil Engineers, besides 7 *hors cadre* or Supernumerary.

Sub-Lieutenants.—90 Civil Engineer Students serving conditionally, in the employ of Railway Companies.

This gives a total of—

34 Captains.

72 Lieutenants.

90 Sub-Lieutenants.

The Supernumerary Officers were in Naval employ, and as such are not available for Military duties.

The Territorial Army comprised—

12 pensioned Colonels of Engineers,

14 pensioned Lieutenant-Colonels of Engineers, 1 First Class Chief Civil Engineer, and 50 Second Class Chief Civil Engineers with the rank of Lieutenant-Colonel,

45 pensioned *Chefs de Bataillon* of Engineers, 123 First Class Civil Engineers, and 3 retired Captains of Engineers (without a pension),

3 pensioned Captains of Engineers and 67 Second Class Government Civil Engineers, and 14 retired Captains of Engineers (with pension),

18 First Lieutenants,

36 Second Lieutenants,

158 Sub-Lieutenants,

giving a total of 444 of all ranks.

The Government Civil Engineers are all graduates of the *Ecole Polytechnique*.

Recapitulation.

| | | |
|------------------------|-------|---------------|
| Active Army..... | 931 | of all ranks. |
| Reserve | 196 | „ |
| Territorial Army | 444 | „ |
| | <hr/> | |
| | 1,571 | „ |

Appointment and Promotion.

Engineer Officers are appointed in two ways, viz., from students of the *Ecole Polytechnique* at Paris and from non-commissioned officers of the corps. The latter system has only been quite recently introduced.

The *Ecole Polytechnique* prepares young men for various public services, civil, military, and naval, viz., for the Artillery of both Land and Marine Forces, the Corps of Military Engineers, Naval Architects and Constructors, the Navy, the Corps of Naval Hydrographers, Civil and Mining Engineers, the Powder and Saltpetre Works, the State Telegraphs, and the State Tobacco Manufactories.

Candidates are admitted by competitive examination, and the normal course of study lasts two-years.¹

Successful candidates for the Engineers are appointed Sub-Lieutenants in the corps, but before they join for duty, have to go through a course of instruction at the Practical School of Artillery and Engineers, or *Ecole d'Application d'Artillerie et du Génie*, at Fontainebleau. This course lasts two or three years at the most, after which, if the Sub-Lieutenant passes the prescribed final examination, he is posted to the corps as Second Lieutenant, and joins an Engineer Regiment for duty.

This School was at Metz before the Franco-German War. Its object is to give practical and technical instruction to young Officers of the Artillery and Engineers, as well as the Marine Artillery. All students join with the rank of Sub-Lieutenant.

The number of Sub-Lieutenants admitted is annually fixed by the War Ministry. Sub-Lieutenants who are allowed a third year's study, and then fail, are removed.

Non-commissioned officers of Engineers may be given commissions after going through a year's course at the new School for non-commissioned officers of Artillery and Engineers at Versailles. They must have served five years altogether with the colours, and one year as *sous-officier*. They must pass an examination to enter the School, and be reported as fit for a commission.

After leaving the School, they are posted to the Engineer Regiments with the rank of Sub-Lieutenant, and are promoted Second Lieutenant after two years' service in this rank. They may, on their own application, be admitted

¹ The French military training establishments are—

The *Ecole Supérieure de Guerre*, at Paris, or Staff College.

The *Ecole Polytechnique*, at Paris.

The *Ecole Spéciale de St. Cyr*.

The *Ecole d'Application de l'Artillerie et du Génie*, at Fontainebleau.

The *Ecole d'Application de Cavalerie*, at Saumur.

The *Ecole d'Application des Poudres et Saltpêtres*, at Paris.

The *Ecole de Médecine et de Pharmacie Militaire*, at Paris.

The *Ecole d'Administration*, at Vincennes.

The *Ecole Normale de Gymnastique*, at Joinville-le-Pont (near Paris).

The *Ecole Normale de Tir*, at Châlons-sur-Marne.

The *Ecoles Régionales*, at the camps at Châlons, Le Ruchard, and Le Valbonne.

The *Ecoles d'Artillerie* at Douai, La Fère, Versailles, Le Mans, Orleans, Châlons. Bésançon, Bourges, Poitiers, Rennes, Vannes, Angoulême, Clermont-Ferrand, Grenoble, Nîmes, Castres, Toulouse, Tarbes, and Vincennes.

The *Ecoles Régimentaires du Génie*, at Versailles, Montpellier, Arras, and Grenoble.

The *Ecole Militaire d'Infanterie*, at St. Maixent.

The *Ecole des Sous-Officiers de l'Artillerie et du Génie*, at Versailles.

The *Ecole Militaire Préparatoire d'Infanterie*, at Rambouillet.

The *Prytanée Militaire*, at La Flèche.

under certain conditions to the *Ecole Polytechnique* to complete their special training and scientific education.

The School for non-commissioned officers at Versailles was founded by a Decree of the 10th January, 1884, so that this system of giving commissions may be said to be on its trial.

Vacancies in the Corps of Engineers are given to students from the *Ecole Polytechnique* and to non-commissioned officers in the following proportions :—

To the former in the proportion of the total establishment of the Engineer Staff, *plus* half the establishment of the Engineer Regiments ; and to the latter in proportion to the remainder. This is about 4 to 1.

No Sub-Lieutenant can be appointed in the French Army under 18 years of age, and unless he has served two years as *sous-officier*, or studied for two years at the School of St. Cyr or the *Ecole Polytechnique*.

Students from the latter are gazetted to the Engineers in the order in which they pass the final examination at that establishment.

Non-commissioned officers and men of the Army entering the *Ecole Polytechnique* do not count their previous military service towards gaining a commission ; if students are sent to the Practical School before they have completed their two years' study at the *Polytechnique*, they are not commissioned till the two years are completed. In the meanwhile, they continue to wear the uniform of the School and are styled *Elèves du Génie*.

No Sub-Lieutenant can be promoted to Second Lieutenant under two years' service in the rank.

Sub-Lieutenants after passing the Practical School are appointed Second Lieutenants in the order in which they are classed by the Examining Board (*Jury d'Examen*). Service in the rank of Second Lieutenant is reckoned from the day they have completed two years' service as Sub-Lieutenant. Those who, in the opinion of the Examining Board, fail in the final examinations, are suspended, and the War Minister decides in each case what employment, if any, they may be given.

Sub-Lieutenants who may be permitted to complete a third year's course of study are only promoted to Second Lieutenant on the completion of their three years' service as Sub-Lieutenant, and rank in order of merit with the batch in which they leave the School.

When Sub-Lieutenants are taken from the School before completing their two years' service in the rank, they serve with the rank of Sub-Lieutenant until they have completed the studies prescribed by the War Minister for the School ; these, however, may be dispensed with in war.

Second Lieutenants are promoted to First Lieutenants by seniority.

Sous-officiers appointed to Sub-Lieutenancies must serve two years as Sub-Lieutenants before being promoted to Second Lieutenant.

Except in the case of war, no Lieutenant can be promoted to Captain under two years' service as Lieutenant.

Two-thirds of the promotions to the rank of Captain are given by seniority, and one-third by selection. Promotion from Second to First Captain goes by seniority only.

Except in war, no Captain can be promoted to *Chef de Bataillon*, unless he has served four years as Captain. Half the promotions are made by seniority and half by selection among the First Captains.

No *Chef de Bataillon* can be promoted to Lieutenant-Colonel in peace unless he has served at least three years as *Chef de Bataillon* or Major. Promotion to Lieutenant-Colonel is made by selection only.

Promotion to Colonel is made by selection only, but in peace a Lieutenant-Colonel must have served at least two years in that rank to be selected.

Promotion to Brigadier-General, Divisional General, and Field-Marshal is

made by selection only; but, except in war, no Officer can be promoted unless he has served three years in the rank he holds. Promotion to Brigadier-General is made from Colonels on the active list alone, but to Divisional General from Brigadier-Generals on the active and unemployed lists (*en activité et disponibilité*). Promotion to Field-Marshal cannot, by the Law of the 13th March, 1875, take place without the passing of a special Act for the purpose.

All promotions are made in the name of the President of the French Republic.

Lists for promotion by selection giving the special aptitudes of Officers are annually made out at the General Inspection. These lists are submitted to *Commissions Régionales de Classement* formed of Generals Commanding Army Corps, assisted each by an Inspector-General of Engineers. From these, fresh lists are made out and again submitted to a higher Commission, or *Commission Supérieure de Classement*, formed of Generals Commanding Army Corps, assisted by the President of the Committee on Fortifications. By the latter the Officers for promotion *au choix* are finally selected and their names submitted, through the War Minister, to the President of the Republic for approval.

Officers and *Adjoints* of Engineers entitled to pensions must retire from the active list at the ages given below :—

| | |
|---|---------------------|
| Colonels | at 60 years of age. |
| Lieutenant-Colonels | „ 58 „ |
| <i>Chefs de Bataillon</i> | „ 56 „ |
| Captains | „ 53 „ |
| Lieutenants and Sub-Lieutenants | „ 52 „ |
| Principal <i>Adjoints</i> , 1st and 2nd Class.... | „ 60 „ |
| 1st and 2nd Class <i>Adjoints</i> | „ 58 „ |
| 3rd Class <i>Adjoints</i> | „ 56 „ |

Engineer Officers may be transferred under certain conditions to the following Departments :—

The Pay and Account Department (*Corps du Contrôle*).
 The Military Intendence.
 The Military Train.
 The Gendarmerie.

Engineer Officers may be admitted by competitive examination to the Staff College or *Ecole Supérieure de Guerre* in the proportion to the other arms fixed by the War Minister. The candidate must not be above the rank of Captain, nor have less than five years' service in the commissioned ranks, during three of which he must have been actually doing duty (*service effectif*). In the case of the Artillery and Engineers one of these years may have been passed in a Training Establishment.

Captains of the Engineer Staff, Captain-Adjutant-Majors of the Engineer Regiments, and Lieutenants and Sub-Lieutenants of the Engineer Train are allowed a riding horse in peace, the property of the public. Captains of the Engineer Train are allowed two horses on the same terms.

In war or in Algeria, Captains of the Engineer Staff and Captains of the Engineer Train would be given two horses each. Captains with companies, Subalterns, and *Adjoints du Génie* would be given one horse each.

By repayment either in one or two instalments, a General of Division may be furnished either in peace or war with 6 horses; a Brigadier-General with 4; a Colonel of the Engineer Staff with 3; a Lieutenant-Colonel in peace with 2, and in war or in Algeria with 3; Colonels and Lieutenant-Colonels of

Engineer Regiments and *Chefs de Bataillon* of the Engineer Staff in peace or war with 2; *Chefs de Bataillon* of Engineer Regiments in peace with 1, and in war or in Algeria with 2; and Majors in peace or war with 1.

OFFICERS OF THE RESERVE AND TERRITORIAL ARMY.

In war, the Corps of Engineer Officers would be augmented by a certain number of Reserve Officers. These would be pensioned Officers of Engineers, Engineer Officers who have resigned their commissions, Civil Engineers from the *Ecole Polytechnique*, volunteers or enlisted men passed into the Reserve with the rank of Sub-Lieutenant, and ex-non-commissioned officers of Engineers with certain certificates of proficiency.

The Reserve Officers for the Railway Companies are *employés* of Railway Companies liable for service in the Reserve or Territorial Army.

Reserve Officers, after serving their prescribed time in the Reserve, are transferred to the Territorial Army, unless they apply to remain in the Reserve.

Officers of the Territorial Army comprise such Officers as have served their time as Reserve Officers, and Officers of Engineers who have resigned their commissions, but who have successfully passed the *Ecole d'Application* and wish to serve in the Engineers if called out for war. They would serve with the rank they held on leaving the Standing Army.

Engineers of Public Works belonging to the Territorial Army would take military rank according to the civil rank they held, thus :—

| | |
|--------------------------------|--|
| Chief Engineer of Public Works | as Lieutenant-Colonel. |
| Engineer of Public Works, | 1st Class, as <i>Chef de Bataillon</i> . |
| " | " 2nd " " Captain. |
| " | " 3rd " " Lieutenant. |
| Engineer students | " Sub-Lieutenant. |

DUTIES AND EMPLOYMENT IN PEACE.

A. THE WAR MINISTRY.

There is no Chief or Inspector-General of the Engineer arm in the French Army.

Inspectors are annually appointed to inspect the Engineer troops, establishments, &c. ; these may be General Officers or Colonels of Engineers.

The French War Ministry is organized in a Central Office, the Office of the General Staff, a Financial Direction, and seven Directions for various Arms and Departments. The fourth is the *Direction du Génie*, and comprises what we should call the business both of the Deputy-Adjutant-General and Inspector-General of Fortifications. It is divided into two *Bureaux*, one for *personnel* and the other for *matériel*. The *Directeur* or Head of the Direction should be a Brigadier-General, but at the beginning of the present year the office was filled by a Colonel. The first Bureau gives employment to 3 Field Officers and Captains and 3 *Adjoints du Génie*, and the second Bureau to 9 Field Officers and Captains, and a like number of *Adjoints du Génie*.

Besides the above, the War Ministry comprises a certain number of Consulting Committees and Commissions (18 in all) on the different Arms, Departments, &c., of the Army.

Those in which the Engineers are more directly concerned are—

The *Comité Consultatif des Fortifications*, or Engineer Consulting Committee.

The *Commission Mixte des Travaux Publics*, or Public Works Commission.

The *Commission Militaire Supérieure des Chemins de Fer*, or Commission on Military Railways.

The *Commission de Télégraphie Militaire*, or Commission on Military Telegraphs.

The *Commission des Substances Explosives*, or Commission on Explosives.

The *Commission Supérieure de l'Artillerie et du Génie*.

The *Commission Mixte d'Examen des Armes et Engins de Guerre*.

They are, however, represented on the following other Committees and Commissions, viz. :—The *Comité de Défense*, the *Conseil Supérieur de la Guerre*, the *Comité Consultatif d'Etat Major*, the *Comité Consultatif de l'Artillerie*, the *Comité Consultatif des Poudres et Salpêtres*, the *Conseil de Perfectionnement de l'Ecole Supérieure de Guerre*, the *Conseil de Perfectionnement de l'Ecole Polytechnique*, the *Commission Supérieure et Consultative des Subsistances Militaires*, the *Commission Supérieure de l'Habillement et du Campement*, the *Commission de Couchage des Troupes*, and the Commission for Administering the Legacy of Marshal Baraguay d'Hilliers.

The Comité Consultatif des Fortifications.

This is also sometimes called the *Comité Consultatif du Génie*. It dates from the year 1776, when it was formed under the name of *Conseil des Fortifications*. The duties and responsibilities are laid down by the Decrees of the 11th March, 1850, and 31st January, 1885.

It is a purely consulting body, and has no executive power whatever. It comprises a President, six Members, and a Secretary. The President is a Divisional General of Engineers, and two of the Members must belong to other arms of the Service—generally Infantry and Artillery. The Members are all General Officers as a rule; the Secretary is a Field Officer of Engineers. Half the total Committee is renewed every year.

The Committee examines and reports upon all matters referred to it by order of the War Minister, but can make no experiments entailing expense without the sanction of the latter.

The Committee applies directly to the War Minister for the presence or assistance of such Officers of Engineers as may appear desirable, and puts itself in communication through the same channel with other Arms and Departments.

The President submits personally every Sunday a weekly report of the doings of the Committee. The Committee presents annually to the War Minister a *résumé* of the reports made by the Inspectors-General of Engineers, of projects for works of defence, &c., and a classification, in order of their importance, of various works proposed for the forthcoming year, but in this the Committee does not touch on the question of expense; this is entirely left to the War Minister himself, who allots the estimates voted according to the reports of the Inspectors-General.

The Committee makes out the distribution of the Officers and *Adjoints* of the Engineers, but in numbers only and not in names. The distribution of the Officers and *Adjoints* themselves, in accordance with the numbers decided on by the Committee, rests with the Bureau for the *personnel* of the fourth (or Engineer) direction of the War Ministry, but before being approved of by the War Minister, is submitted to the Committee for modifications that may appear desirable in the interests of the Service.

The Commission Mixte des Travaux Publics.

This is a mixed Civil, Military, and Naval Commission to enquire into such public works as are proposed, so as to safeguard various public interests, civil, military, or naval.

It is under the Presidency of a *Conseiller d'Etat*. The military element of the Commission comprises two Inspectors-General of Engineers, an Inspector-

General of Artillery, and two Inspectors-General of the other Arms. Including the President, there are fourteen members besides a Secretary. The latter is either a Field Officer of Engineers belonging to the Fortification *Dépôt* or a Chief Engineer of Public Works.

The Inspectors-General of Engineers belonging to this Commission are generally Members of the Committee on Fortifications.

The Commission Militaire Supérieure des Chemins de Fer.

This was created in 1872. It comprises a President, a Vice-President, nine members, and a Secretary. In 1885, only one member was an Engineer Officer—a Colonel. The Secretary was an Engineer Officer on the General Staff.

The Commission de Télégraphie Militaire.

This was created in 1874. It comprises a President, eleven members, and a Secretary. Two, besides the Secretary, were Engineer Officers in 1885.

The Commission des Substances Explosives.

This was created in 1878. It comprises a President, six members, and a Secretary. Two were Engineer Officers in 1885.

The Commission Supérieure de l'Artillerie et du Génie.

This is a mixed Commission of Artillery and Engineer Officers on purely Artillery and Engineer questions. The numbers, &c., of the Commission are not known.

The total number of Engineer Officers employed at the War Ministry in 1885 was some forty-four of all ranks, besides twelve *Adjoints du Génie* of various classes.

B. BRANCHES AND DEPARTMENTS NOT FORMING PART OF THE WAR MINISTRY.

The Dépôt des Fortifications.

This was created in 1791 under the name of *Archives des Fortifications*, to assist in the work of the Committee (then *Conseil*) on Fortifications. It is a kind of record office where all Engineer plans, projects, drawings, maps, memoirs, &c., are deposited. By a Royal Order of the 27th August, 1830, it was placed immediately under the Committee, the President of the latter acting as Director, and the Secretary as Sub-Director. It comprises, besides these, some ten Officers and seven *Adjoints* of Engineers, and a staff of civilian draughtsmen and clerks, and a civilian Chief Clerk. By an Order of the 11th June, 1878, the Military Ballooning Department (*Service de l'Aérostation Militaire*) now belongs to the *Dépôt*.

There is a very valuable technical library belonging to the *Dépôt*. It is in charge of a pensioned Field Officer of Engineers as Librarian.

By a Ministerial decision of the 30th May, 1885, the *Commission des Communications par Voie Aérienne*, or Commission on sending messages by carrier pigeons, optical telegraphy, and the electric light, &c., is placed under the Director of the Fortification *Dépôt*, the Sub-Director of the same acting as President. There are five members, one is an Artillery Officer, and the remainder Engineer Officers.

The Galerie des Plans Reliefs.

A collection of models of fortified places was commenced in 1660, and at first placed in the Museum of the Louvre. It was transferred to the

Invalides in 1777, where it still remains. It is in the immediate charge of the Director of the Fortification Dépôt under the Committee of Fortifications. The *personnel* comprises a retired Field Officer of Engineers as custodian, three draughtsmen, and two modellers.

The Central Dépôt of Scientific Instruments.

This was created in 1878. Its object is to furnish the Engineers with scientific instruments, either for permanent or temporary use. It is under the Director of the Fortification Dépôt, and is in immediate charge of a pensioned Field Officer of Engineers assisted by an *Adjoint du Génie*.

The Brigade Topographique du Génie (Topographical Brigade).

This was created in 1813. Its present organization is that laid down by a Ministerial Order of January, 1850, since modified by Ministerial Order in February, 1861, and April, 1873. It is a Survey Branch of the Engineers, and until quite recently was under the immediate direction of the Committee on Fortifications, but by a Decree of the 16th May, 1885, it is now, both as regards *personnel* and *matériel*, attached to the General Staff of the War Ministry, and belongs to the *Dépôt de la Guerre, Service Topographique*, or Survey Branch of the General Staff, which in France does the work of the Ordnance Survey of our Service. It is commanded by a Field Officer or Captain of Engineers. Its duties are to make surveys for fortifications and other engineering works. It is organized in a Central Section in Paris, where plans, drawings, &c., are completed, and a variable number of working sections stationed in different parts of the country. In 1885 there were three working sections with headquarters at La Fère, Besançon, and Grenoble. The sections are generally commanded by Captains.

Including the Commandant at Paris, there were 5 Officers, 17 *Adjoints du Génie*, and 9 *Adjoints*, or Probationary *Adjoints*, employed in the Branch altogether in 1885.

The Offices of the Committee on Fortifications, the Mixed Commission on Public Works, and the Fortification Dépôt, are at No. 8, Rue Saint Dominique, Paris.

The *Galerie des Plans Reliefs*, the *Dépôt Central des Instruments de Précision*, and the *Commission des Communications par Voie Aérienne*, are *annexes* or branches of the *Dépôt des Fortifications*.

The Service des Cuirassements (Armour-plate Department).

This was created in 1878, and placed under the Director-General of Engineers of the Paris Government. Its object is to generally prepare designs and plans for armour-plating, and to see contracts for the same carried out. It has to see to the delivery of armour-plates at the works, and to generally superintend all work connected with armour-plated forts and batteries. There were two Officers only employed on it in 1885.

The Office is at No. 39, Rue Belle Chasse, Paris, near the War Ministry.

Etablissements du Génie (Engineer Establishments).

These comprise the *Dépôt des Fortifications* and the *Galerie des Plans Reliefs* already alluded to, the four Schools of Military Engineering for the training of the Engineer Regiments, and the eight District Engineer Commands and thirty-two District Engineer Directions.

The *Dépôt des Fortifications* with its branches or *annexes*, the *Galerie des Plans Reliefs*, the Central Dépôt of Scientific Instruments, the *Commission des*

Communications par voie aérienne, and the Topographical Brigade have already been described. The eight District Engineer Commands and thirty-two District Engineer Directions refer to the permanent territorial duties of the Engineer Staff in peace.

The Eight District Engineer Commands and Thirty-two District Engineer Directions.

According to the Law of the 12th May, 1814, which is still in force, the Engineer Staff undertakes the construction, maintenance, and repair of all fortifications and military works and buildings at home and abroad, in peace or war, the only exception being certain buildings belonging to Artillery establishments, which the Artillery authorities see to themselves.

Thus the French Engineer Staff has much the same kind of departmental work as our "Royal Engineer Department."

These territorial or district duties, generally known as the *Service du Génie*, are organized in 32 Engineer Local Directions. Of these, 32 are in France, 3 in Algeria, and 1 in Tunis. Each Direction is subdivided into from two to eight *Chefferies* or Sub-Directions. The Directions are under "Directors" or *Directeurs du Génie*, and the *Chefferies* under *Chefs du Génie*.

Army Corps Districts Nos. 1, 6, 7, 11, 14, 15, 16, and 18, and the Military Government of Paris, comprise two Directions each. The remaining Army Corps Districts one Direction each only. The 19th Army Corps (Algeria) comprises three Directions.

In Army Corps Districts having one Direction only the Director of the Direction acts as the Commanding Engineer of the District on the Staff of the General Commanding it, with the simple title of *Directeur du Génie de la —e Région*.

In Army Corps Districts having two Directions there is a higher Officer as Commanding Engineer of the District—a Brigadier-General—who is given an aide-de-camp—a Captain. He is styled *Commandant du Génie de la —e Région*, the appointment being styled *Commandement régional du Génie*.

In the 19th Army Corps District the Commanding Engineer is styled the *Commandant Supérieur du Génie du 19^e Corps d'Armée*. He is given a Chief of the Staff, a Field Officer, and an aide-de-camp—a Captain.

In the Military Government of Paris the Commanding Engineer has many important duties to perform, and is a Divisional General with a Chief of the Staff and an aide-de-camp.

The Director of the Paris Direction of the Military Government of Paris is a Brigadier-General. Other Directors are Colonels, and very rarely Lieutenant-Colonels. The *Chefs du Génie* are Lieutenant-Colonels or *Chefs de Bataillon*, and very rarely Captains.

The Tunis Direction belongs to the army of occupation (*Division d'occupation*). It is under a Lieutenant-Colonel.

Military defences, works, and buildings in Martinique, Guadeloupe, Senegal, Cochin China, and other small French Colonial possessions are in charge of Engineer Officers on the supernumerary list, and serving for the time under the Ministry of Marine.

The following is the present arrangement of the Engineer Directions :—

| Command. | Headquarters. | Engineer Directions. |
|---|-------------------------|--|
| The Military Government } of Paris | Paris | 1st Paris 5 <i>chefferies</i> . |
| 1st Army Corps district .. | Lille | 2nd Versailles 4 " |
| 2nd " " .. | Amiens | 3rd Lille 6 " |
| 3rd " " .. | Rouen | 4th Arras 5 " |
| 4th " " .. | Le Mans | 5th Amiens 6 " |
| 5th " " .. | Orleans | 6th Rouen 4 " |
| 6th " " .. | Châlons-sur- Marne { | 7th Le Mans 3 " |
| 7th " " .. | Besançon { | 8th Orleans 5 " |
| 8th " " .. | Bourges | 9th Châlons-sur- Marne ... } 7 " |
| 9th " " .. | Tours | 10th Naney 8 " |
| 10th " " .. | Rennes | 11th Besançon 4 " |
| 11th " " .. | Nantes | 12th Langres 4 " |
| 12th " " .. | Limoges | 13th Bourges 3 " |
| 13th " " .. | Clermont | 14th Tours 6 " |
| 14th " " .. | Lyons | 15th Rennes 5 " |
| 15th " " .. | Marseilles | 16th Nantes 3 " |
| 16th " " .. | Montpellier..... { | 17th Brest 3 " |
| 17th " " .. | Toulouse | 18th Limoges 3 " |
| 18th " " .. | Bordeaux | 19th Clermont..... 3 " |
| 19th Army Corps | Algiers | 20th Lyons 2 " |
| | | 21st Grenoble 5 " |
| | | 22nd Marseilles 5 " |
| | | 23rd Toulon 3 " |
| | | 24th Montpellier ... 3 " |
| | | 25th Perpignan 4 " |
| | | 26th Toulouse 2 " |
| | | 26th Bordeaux 3 " |
| | | 28th Bayonne 2 " |
| | | 29th Algiers 7 " |
| | | 30th Oran 6 " |
| | | 31st Constantine.... 6 " |

The Tunis Direction has no number ; it comprises 3 *chefferies*.

The total number of Officers employed on district duties comprised in the above Directions, in 1885 were—

| | |
|---|------------------------------------|
| 1 Divisional General | } As <i>Commandants du Génie</i> . |
| 9 Brigadier-Generals | |
| 1 Brigadier-General | |
| 31 Colonels and Lieutenant-Colonels | } As <i>Directeurs du Génie</i> . |
| 138 Lieutenant-Colonels, <i>Chefs de Bataillon</i> , and Captains } | |
| 2 <i>Chefs de Bataillon</i> | As Chiefs of the Staff. |
| 10 Captains | As Aides-de-Camp. |

And some 228 Officers of various ranks above that of First Lieutenant, and 818 *Adjoints du Génie* of various classes.

Besides these there are a good many Officers temporarily attached to the Directions, and many are on command from the Engineer Regiments. The total number employed in various ways by the Directions is not far short of 480 of all ranks.

The total number of Officers belonging to the Expeditionary Force in Tonquin was, according to the "*Etat du Génie*" for 1885 :—

- 1 Colonel in command.
- 1 Lieutenant-Colonel as Chief of the Staff.
- 2 *Chefs de Bataillon*, as Commanding Engineers of the two Divisions.
- 15 Captains.
- 4 First Lieutenants.
- 1 Sub-Lieutenant.
- 8 *Adjoints de Génie* of various classes.

TRAINING ESTABLISHMENTS FOR THE ENGINEERS.

The *Ecole Polytechnique* at Paris is of a civil as well as military nature, and its object has already been sufficiently alluded to (see p. 1195). The Commandant is a Brigadier-General of Artillery or Engineers, and the Second Commandant a Colonel or Lieutenant-Colonel of Engineers or Artillery, alternately.

The Staff comprises—

Six Captains of Artillery and Engineers as Cadet Officers, 10 Examiners, 25 Professors and Instructors, 22 *répétiteurs* and assistant *répétiteurs*, a secretary, an architect, a librarian, a treasurer and assistant treasurer, a storekeeper and assistant storekeeper, a chief clerk, a clerk of works, 3 curators of records, scientific collectors, &c., 2 surgeons, and a dentist.

The *Conseil de Perfectionnement* comprises the Brigadier-General Commandant of the School as President, and 17 members including the Second Commandant.

The majority of the Professors, Instructors, &c., are civilians. In 1886 there were six Engineer Officers employed in the School altogether, including the Second Commandant. Two of these were on the retired list.

The number of students annually admitted is 250. Admission is by open competition. The course lasts two years. The following is the average number of annual appointments made from the School in the various public services.

- From 40 to 50 in the Engineers.
- „ 60 to 80 in the Artillery.
- „ 2 to 4 in the Corps of Engineers of the Gunpowder Factories.
- „ 4 in the Navy.
- „ 10 to 20 in the Marine Artillery.
- „ 10 in the Corps of Naval Constructors.
- „ 1 to 2 in the Corps of Naval Hydrographers.
- „ 60 to 80 in the Corps of Engineers of the Public Works Department, Mines, Telegraphs, and various manufacturing branches in the public service, and of certain Railway Companies.

The School is under the Artillery Direction of the War Ministry.

The *Ecole d'application d'Artillerie et du Génie* at Fontainebleau is of a purely military nature, the students being all commissioned Officers. Its object has already been alluded to (see p. 1195).

The Commandant is a Brigadier-General of Artillery or Engineers, and the Second Commandant a Colonel or Lieutenant-Colonel of Engineers or Artillery, alternately.

The Military Staff of the School comprises besides these, 15 *Chefs de Bataillon* (or *Chefs d'Escadron*) and Captains of Artillery or Engineers, two Surgeons, and a Veterinary Surgeon; and the Administrative Staff four retired Officers of Artillery or Engineers as curator, librarian, secretary, treasurer and store-keeper, and one *Adjoint du Génie*, or clerk of works.

The Instructional Staff comprises 31 Professors and Instructors, all Officers of Artillery or Engineers, excepting the Professors and Instructors of German, who may be Officers of the other arms.

The number of Sub-Lieutenants (*Sous-Lieutenant-élèves*) studying at the School in 1885 was 100, and 1 Second Lieutenant on command from the 2nd Regiment, and 1 Sub-Lieutenant from the 1st Regiment.

The subjects taught at the School are : artillery, fortification, construction, applied sciences, mechanics, military art, topography, German, drawing, and riding.

The School is under the Engineer Direction of the War Ministry.

The *Ecole des Sous-Officiers de l'Artillerie et du Génie* at Versailles was created by a Decree of the 10th January, 1884, in connection with the new system of giving Commissions in the Artillery and Engineers to non-commissioned officers of these services. Its object has already been alluded to.

The Commandant is a Colonel of Artillery or Engineers, and the Second Commandant a *Chef de Bataillon* of Engineers or a *Chef d'Escadron* of Artillery, alternately. Besides these, the military Staff comprises a treasurer (a subaltern of Artillery or Engineers), a storekeeper (an *Adjoint du Génie*), and a surgeon.

The Instructional Staff is entirely military. It comprises 11 Professors and Instructors—Captains or subalterns of Artillery or Engineers. In 1885 it included 4 Officers of Engineers.

The *Ecoles Régimentaires du Génie*, or the four Regimental Schools of Military Engineering, are purely Engineer establishments for the training of the Engineer Regiments, and are classed with the *Etablissements du Génie*, or Engineer Establishments (see p. 1214).

They are known as the *Ecoles de Versailles*, *de Montpellier*, *d'Arras*, and *de Grenoble*, where the 1st, 2nd, 3rd, and 4th Regiments of Engineers are respectively quartered.

The instruction and training in these schools is to a great extent done by the Officers of the Regiment, and the Colonels in command are generally responsible for the proper training of their Regiments. Certain matters are, however, more in the hands of the Commandants of the schools, who are Lieutenant-Colonels of the Engineer Staff. These are each assisted by two First Captains belonging either to the Engineer Staff, or detached from their Regiments. There are at each school three civilian Professors of mathematics, drawing, and grammar. These are entirely under the School Commandant. The Staff of each school comprises besides two *Adjoints du Génie* and an *ouvrier d'Etat*.

The school at Versailles is larger than the other three, as the four Railway Companies of the four Regiments of Engineers are attached to it. The Railway Branch of this school has further been lately increased by the conversion of the 20th Battalion of Engineers, formerly belonging to the 3rd Regiment at Arras, into a Railway Battalion. This Battalion is, however, still shown in the "*Etat du Génie*" as a Battalion of *Sapeurs-Mineurs*. There are thus now, nominally at any rate, eight Railway Companies.

The first school comprises, besides the Staff already described, a *Chef de Bataillon* as *Chef du Service des Parcs de Chemins de Fer*, and 1 *Adjoint du Génie*, and 2 *Stagiaires* (or Probationary *Adjoints du Génie*) belonging to the same, besides 2 additional *Adjoints du Génie* and 1 additional *ouvrier d'Etat*, making the total Staff 16 instead of 9.

One of the four schools receives every year in succession a batch of Infantry

Captains to go through a course of field fortification of four weeks in October. For this purpose the Infantry is divided into four groups corresponding with the four schools. About 45 Captains annually attend the course, every Regiment of Infantry or Battalion of Chasseurs sending, as a rule, a Captain every fourth year.

The training of the Engineer Regiments is laid down in the minutest detail in the Regulations of the 25th June, 1885, the main features of which are given further on under the heading of Engineer Troops (see p. 1211).

PART II.—ENGINEER TROOPS.

Peace Organization.

The Engineer Troops of the Standing Army are organized in peace in four Regiments of Engineers (*Régiments du Génie*), or Sappers and Miners (*Sapeurs-Mineurs*), attached to the four Schools of Military Engineering, or *Ecoles Régimentaires du Génie*, at Versailles, Montpellier, Arras, and Grenoble respectively.

Each Regiment consists of 5 battalions of 4 Companies of Sappers and Miners each, 1 dépôt Company, a Railway Company, or *Compagnie d'Ouvriers de Chemins de Fer*, and a Company of Engineer Train, or *Compagnie de Sapeurs Conducteurs*.

The Regiments are numbered 1 to 4 in the order given above, but the 20 Battalions are numbered from 1 to 20, independently of the Regiments and corresponding to the Army Corps they would belong to in war. In peace the five Battalions are stationed with the headquarters of the Regiment, having certain Companies detached, but on mobilization each Battalion would join the Army Corps bearing its number. As there are 19 Army Corps of the Standing Army this left one Battalion, the 20th, over and above in reserve. This Battalion was converted into four Railway Companies by a Ministerial Circular of July, 1884.

The four Railway Companies are attached in peace to the 1st Regiment at Versailles.

In peace certain Companies are detached for service in Algeria and Tunis (at present three), and at present there is a Company serving in Tonquin.

The 1st Regiment at Versailles comprises the 5th, 9th, 10th, 11th, and 20th Battalions; the 2nd Regiment at Montpellier, the 12th, 16th, 17th, 18th, and 19th Battalions; the 3rd at Arras, the 1st, 2nd, 3rd, 4th, and 6th Battalions; and the 4th Regiment at Grenoble, the 7th, 8th, 13th, 14th, and 15th Battalions.

All these Battalions are permanently stationed in peace with the headquarters of the Regiments they belong to, the 1st Battalion having in the beginning of the present year a Company detached at Verdun, the 2nd Battalion a Company at Toul and Commercy, the 3rd Battalion a Company at Epinal, the 5th Battalion a Company at Fontainebleau and a Company at Langres, the 6th Battalion a Company at Longwy, the 7th Battalion a Company at Belfort, the 9th Battalion a Company at the Camp of the *Pas des Lanciers*, the 10th Battalion a Company at Paris and a Company at Besançon, the 12th Battalion a Company at Constantine in Algeria, the 13th Battalion a Company at the Camp of Sathonay and a Company in Tonquin, the 14th Battalion a Company at Briançon, the 15th Battalion a Company at Nice and a Company at Tournoux St. Vincent, the 16th Battalion a Company at Tunis, the 17th Battalion a Company at Algiers, and the 18th Battalion a Company at Orar.

The Regiments of Engineers are exclusively officered from the Corps of Engineer Officers as in our Service, but all Officers below the rank of Second Captain are shown as belonging to the Regiments, except the Sub-Lieutenants studying at the *Ecole d'Application*; these are shown as belonging to the Engineer Staff.

The total number of Officers belonging to the Regiments fixed by Law has been given at p. 1192.

The Staff of a Regiment comprises—

- 1 Colonel in command.
- 1 Lieutenant-Colonel.
- 5 *Chefs de Bataillon* to command Battalions.
- 1 Major.¹
- 1 Paymaster (a Captain).
- 1 Assistant-Paymaster (a Subaltern).
- 1 Clothing Officer (a Captain).
- 1 Ensign (a 2nd Lieutenant or Sub-Lieutenant).
- 2 Surgeons.
- 1 Veterinary Surgeon.
- 1 Bandmaster.²

The non-commissioned staff, or *pétit état major* and *peloton hors rang*, comprises—

- 5 Adjutants (*Sous-Officiers*).
- 45 Bandsmen and buglers.
- 3 Sergeant-majors.
- 3 Sergeants.
- 1 Quartermaster-corporal.
- 7 Corporals.
- 15 Sappers.

Total, 79 non-commissioned officers and men, making the total Staff of a Regiment, 16 Officers, 79 non-commissioned officers and men, with 16 riding horses.

An Engineer Regiment has a colour and a band.³ These remain at home on mobilization.

The establishment of a Company of Sappers and Miners in peace is—

- 1 First Captain (*Capitaine Commandant*).
- 1 Second Captain (*Capitaine en Second*).
- 1 First Lieutenant.
- 1 Second Lieutenant or Sub-Lieutenant.
- 28 Non-commissioned officers.
- 80 Sappers.

Or a total of 4 Officers and 108 non-commissioned officers and men.

The establishment of a Railway Company is the same, except that a Captain may be substituted for one of the subalterns, and the number of sappers is 100.

The establishment of a Company of Engineer Train comprises 4 Officers

¹ There is no rank of Major in the French Army. There is a "Major" to every regiment; it is an appointment, or *emploi*. The Major of a French regiment is either a Captain or *Chef de Bataillon*, and his duties are purely administrative.

² The bandmaster, or *chef de musique*, is a commissioned Officer in the French Service.

³ The band of the 1st Regiment is one of the best in the French Army. Many of our readers may have heard it perform at the "Healtheries" in 1884.

(the same as in a Company of Sappers and Miners), 36 non-commissioned officers, 80 drivers, and 120 horses.

A *Dépôt* Company has the same establishment as a Company of Sappers and Miners, except that there is no Second Captain.

The total establishment of a Regiment is then—

9 Field Officers.
98 Officers.
731 Non-commissioned officers.
1,860 Sappers and drivers.

Or 107 Officers and 2,591 non-commissioned officers and men.

The four Regiments number therefore—

428 Officers.
10,364 Non-commissioned officers and men.

Or 10,792 of all ranks.

The *Effectif Budgétaire* of the Engineers is laid down as 914 Officers and 10,502 non-commissioned officers and men.

According to the Army List of 1885 the 1st Regiment had 100 Officers, the 2nd Regiment 99, the 3rd Regiment 104, the 4th Regiment 95, and the 4 Railway Companies 13 Officers only of all ranks, giving a total of 411 Officers of all ranks, or 17 below the total establishment.

Again, some 70 Officers are detached or on command, so that the total number of doing-duty Officers is about 87 below what it should be.

The 1st Regiment had in 1885 a list of 11 Lieutenants and 17 Sub-Lieutenants in the Reserve, the 2nd Regiment 8 Lieutenants and 21 Sub-Lieutenants in the Reserve, the 3rd Regiment 5 Lieutenants and 21 Sub-Lieutenants in the Reserve, and the 4th Regiment 8 Lieutenants and 21 Sub-Lieutenants in the Reserve.

The 4 Railway Companies had 1 Captain and 9 Sub-Lieutenants in the Reserve.

Recruiting.

The 4 Regiments of Engineers of the Standing Army, *minus* the 20th Battalion and the 4 Railway Companies, receive annually 2,007 recruits from the first portion of the annual contingent, and 720 enlisted men for 5 years' nominal training, giving 502 of the former and 180 of the latter per Regiment.

The total number of men annually enrolled for 5 years' training is then 2,727 altogether. The training as a matter of fact, however, is only a little over 3 years. This gives, deducting casualties—

Army of the 1st Line—

| | | |
|-------------------------|---|------------|
| With the colours | 4 contingents nominally, or | 10,268 men |
| <i>En disponibilité</i> | 1 " " | 2,413 " |
| Reserve | 4 " " | 9,161 " |
| | | <hr/> |
| Total | | 21,842 " |

Army of the 2nd Line—

| | | |
|------------------|---|------------|
| Territorial Army | 5 contingents, or | 10,465 men |
| Reserve of do. | 6 " " | 11,232 " |
| | | <hr/> |
| Total | | 21,697 " |

Besides the above, a certain number of men are annually taken for a service of 12 months only. 612 of such men are taken by the Engineers. This gives, deducting casualties—

Army of the 1st Line—

| | | | | |
|-------------------------|---------|----------------|-------|-----|
| With the colours | 1 | contingent, or | 612 | men |
| <i>En disponibilité</i> | 4 | „ | 2,214 | „ |
| Reserve | 4 | „ | 2,034 | „ |
| Total | | | 4,860 | „ |

Army of the 2nd Line—

| | | | | |
|------------------|---|-----------------|-------|-----|
| Territorial Army | 5 | contingents, or | 2,322 | men |
| Reserve of do. | 6 | „ | 2,496 | „ |
| Total | | | 4,818 | „ |

Territorial Battalions.

Each Army Corps District furnishes a Territorial Battalion of Engineers bearing its number. The Companies vary in number, the numbers being fixed from time to time by the War Minister.

At the beginning of the present year there were 9 Companies in the 1st Battalion, 4 in the 2nd, 4 in the 3rd, 3 in the 4th, 3 in the 5th, 5 in the 6th, 3 in the 7th, 2 in the 8th, 2 in the 9th, 2 in the 10th, 2 in the 11th, 3 in the 12th, 5 in the 13th, 3 in the 14th, 5 in the 15th, 4 in the 16th, 3 in the 17th, and 4 Companies in the 18th Battalion, giving a total of 66 Companies.

A Battalion is commanded by a *Chef de Bataillon*, but there are no Battalion Staffs in peace.

The total number of Company Officers given in the *Etat du Génie* for 1885 was—

| |
|------------------------------------|
| 62 Captains |
| 51 Lieutenants (First and Second). |
| 50 Sub-Lieutenants. |

Total 163 or an average of 2.48 Officers per Company.

There are 4 Territorial Dépôts for these Battalions stationed at the four Schools of Military Engineering.

They comprise each a Major—a *Chef de Bataillon* of the Territorial Army—and two Sub-Lieutenants of the same—Acting Paymaster and Clothing Officer respectively.

To recapitulate :—

Trained Men—

| | | |
|---------------------------|--------|----------|
| Standing Army and Reserve | 21,842 | men |
| Territorial „ „ | 21,697 | „ |
| | | 43,539 „ |

Partially Trained Men—

| | | |
|---------------------------|-------|---------|
| Standing Army and Reserve | 4,860 | „ |
| Territorial „ „ | 4,816 | „ |
| | | 9,676 „ |

Total more or less trained Engineer Troops in Active and Territorial Armies, 53,215.

A certain number of men are annually excused serving with the colours in peace-time. Of these, 1,200 are detailed for the Engineers. The 20 contingents of such men would give, deducting casualties, some 19,358 men. As they receive no military training whatever, they may be neglected.

The Railway Companies are not included in the above.

Of the annual contingent taken for 5 years, 176 are taken for these Companies, and to these should be added 96 enlisted men, giving a total of 272 recruits each year for the 8 Companies that now exist.

The Railway Companies do not take any men of the second portion of the contingent.

The Engineers are recruited throughout France, every Sub-district having to furnish a certain number of men of the first portion of the contingent, and a certain number of Sub-districts, men of the second portion. In the latter case, the Sub-districts are always comparatively near the headquarters of the Regiment the recruits are to be sent to. In the former case this is by no means the case, the men being taken throughout the length and breadth of the country.

Thus the 1st Regiment at Versailles draws its recruits of the first portion from 33 Sub-districts scattered throughout the country, from Arras in the north to Montpellier in the south, and Brest in the west to Grenoble in the east. The same Regiment draws the recruits of the second portion from 14 Sub-districts, situated chiefly in the north-western part of France. The 2nd Regiment draws its recruits of the first portion from 33 Sub-districts throughout the country, and the recruits of the second portion from 25 Sub-districts chiefly in the south-western part of France. The 3rd Regiment draws its first portion from 43 Sub-districts throughout the country, and its second portion from 18 Sub-districts chiefly in the north of France. The 4th Regiment draws its first portion from 40 Sub-districts throughout France and Corsica, and its second portion from 22 Sub-districts chiefly in the eastern and south-eastern part of France. The newly-made Battalion of Railway Companies, formerly the 20th Battalion of Engineers, draws its recruits from 33 Sub-districts.

The 1st Railway Company draws its recruits from 12 Sub-districts, the 2nd from 13, the 3rd from 10, and the 4th from 13 Sub-districts scattered throughout France from north to south and east to west.

The proportion of men of various trades to be selected from the annual contingent of recruits for the Regiment of Engineers are as follows :—

| | For the 1st Regiment. | For the 2nd Regiment. | For the 3rd Regiment. | For the 4th Regiment. |
|--|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Of carpenters, joiners, &c. | $\frac{5}{30}$ ths | $\frac{6}{30}$ ths | $\frac{6}{30}$ ths | $\frac{6}{30}$ ths |
| Of bricklayers and stonemasons .. | $\frac{2}{30}$ ths | $\frac{1}{30}$ th | $\frac{2}{30}$ ths | $\frac{1}{30}$ th |
| Of fitters, locksmiths, &c..... | $\frac{1}{30}$ th | $\frac{1}{30}$ th | $\frac{1}{30}$ th | $\frac{1}{30}$ th |
| Of blacksmiths, &c. | $\frac{3}{30}$ ths | $\frac{2}{30}$ ths | $\frac{2}{30}$ ths | $\frac{3}{30}$ ths |
| Of saddlers, harness-makers, and shoeing smiths | $\frac{1}{30}$ th | $\frac{1}{30}$ th | $\frac{1}{30}$ th | $\frac{1}{30}$ th |
| Of drivers and carters | $\frac{4}{30}$ ths | $\frac{4}{30}$ ths | $\frac{4}{30}$ ths | $\frac{4}{30}$ ths |
| Of navvies, miners, and quarrymen | $\frac{12}{30}$ ths | $\frac{13}{30}$ ths | $\frac{13}{30}$ ths | $\frac{13}{30}$ ths |
| Of various trades such as tin- smiths, ropemakers, basket- makers, shoemakers, boatmen, caulkers, mathematical instru- ment makers, draughtsmen, en- gravers, lithographers, photo- graphers, telegraphists, book- binders, painters, &c..... | $\frac{2}{30}$ ths | $\frac{2}{30}$ ths | $\frac{1}{30}$ th | $\frac{1}{30}$ th |

Besides these, young men employed in the Six Great Railways Companies and the State Railways are also selected, according to instructions of the War Ministry, for the Engineer Regiments, and certain young men belonging to carrier pigeon clubs are also set aside for the 1st Regiment at Versailles.

Recruits for the 20th Battalion and the four Railway Companies are not taken from Railway servants, but from tradesmen, &c., likely to make good Railway Sappers, if we may use the term.

The minimum standard for the Engineers and Railway Companies is 1.66 metres, or 5 feet 5.3 inches. There is no maximum standard, as in the Cavalry. Shoeing smiths and collarmakers may be taken at 1.54 metres, or 5 feet 0.6 inches, and armourers, tailors, and shoemakers at 1.62 metres, or 5 feet 3.7 inches.

Recruits belonging to carrier pigeon clubs may, if very desirable men, be taken at 2 or 3 centimetres below the minimum standard, or at 5 feet 4.5 inches or 5 feet 4.1 inches respectively.

TRAINING.

According to the Regulations of the 25th June, 1885, the training of Engineer Regiments is intended to give Officers, non-commissioned officers, and men such special theoretical and practical training as may fit them for the various ranks they hold, as well as in each case for the rank next above.

The instruction is divided into *general or regimental training* and *special or technical training*.

The Colonel in command has general superintendence of the training of his Regiment. He is held responsible that all regulations are properly attended to; he personally attends all instruction, both theoretical and practical, so far as his other duties permit him, and he is supposed to use all his influence to encourage among Officers and men a desire for work and study, and to promote their physical and intellectual welfare.

General or Regimental Training (Instruction Générale ou de Regiment).

The Infantry training regulations apply equally to the Engineers with the exception of the Companies of Engineer Train, and are only slightly modified by certain regulations which apply to the Engineers only.

The Lieutenant-Colonel has special charge of all regimental training in detail, and he gives his instructions and orders to the Officers and non-commissioned officers employed as instructors. His duties and functions are in fact precisely analogous to those of a Lieutenant-Colonel of an Infantry Regiment, as laid down by the Regulations for the regimental duties of the Infantry (*Décret sur le Service intérieur des Troupes d'Infanterie*). These and other regulations give in detail the duties that have to be undertaken by Field Officers, Captains, Subalterns, and non-commissioned officers.

Theoretical Instruction.—The theoretical training of a Regiment is given in the following:—

1. The Decree on regimental duties in Infantry Regiments.
2. The Regulations on the manœuvres of Infantry.
3. The Decree on garrison duties (*service des places*).
4. The Decree on the field duties and practical training of Infantry in the field.
5. The Regulations on the care of arms.
6. The Musketry Instructor's manual.
7. The Regulations for the transport of troops by rail.
8. The Regulations on the method of carrying kits and field equipment.
9. The Regulations on the supply service, so far as the regimental authorities are concerned.

10. The Military Penal Code.

The *Chefs de Bataillon* see that their Officers are constantly practised in the theory of Squad, Company, and Battalion drill, and satisfy themselves as to their proficiency by simple verbal examinations, dealing only very casually with Squad drill.

The Lieutenant-Colonel gives instruction in the theory of Brigade drill. This is not obligatory on Lieutenants and Sub-Lieutenants.

Captains and Subalterns who have constantly attended these classes for two consecutive years may, if they are considered sufficiently proficient, be dismissed further instruction.

Theoretical instruction in drill in close formation (*ordre serré*) is given by the Adjutant-Major of the Battalion to non-commissioned officers and men qualifying for promotion. Besides the Adjutant, who more especially instructs the corporals, the Adjutant-Major has an Officer as an assistant to instruct men qualifying for the stripe. The theoretical instruction in drill in extended order (*ordre dispersé*) of non-commissioned officers and soldiers is left to Captains of Companies.

Theoretical instruction in regimental, garrison, and field duties, and the transport of troops by rail, is given to the Officers by the *Chefs de Bataillon*, to the *sous-officiers* by Lieutenants of Companies under the supervision of the Captains, and to corporals and sappers by the *sous-officiers* under the supervision of the Company Officers.

A class for theoretical instruction in musketry and the care of arms is annually formed in a Regiment. The instruction comprises a perfect knowledge of the Musketry Instructor's manual, a thorough acquaintance with the Regulations of the 1st March, 1884, on the care of arms, and the theory and practice of judging distances. Lectures are given on these subjects to Lieutenants and Sub-Lieutenants by the Captain-Musketry-Instructor (*Capitaine de Tir*), and to *sous-officiers* and corporals by the Musketry Instructors (*Officiers de Tir*). The theory of musketry is also explained in the barrack-rooms to the men by the *sous-officiers* of Companies, under the supervision of the Company Officers.

The stowing of kits and the methods of carrying the field equipment are explained to corporals and sappers in the barrack-rooms, under the supervision of Lieutenants of Companies.

Captains and Lieutenants are instructed in the theory of military administration, so far as it applies to the regimental authorities, by the Major. Non-commissioned officers are instructed in the same by the Paymaster (*Trésorier*) or his assistant (*Adjoint*).

Military Penal Legislation forms a subject for lectures given by the Major or a *Chef de Bataillon* to Captains and Subalterns.

All the above theoretical instruction is carried on as a rule in winter, except in the subject of the transport of troops by rail, lectures on which are given each year immediately before the practical instruction of entraining and detraining takes place. Besides, when exercises in Infantry drill and manœuvres are stopped by bad weather, the Colonel may order lectures or theoretical instruction on the same to take place instead, indoors.

Special instructional cadres are formed for the theoretical instruction in the subjects above enumerated of Officers and men of the Reserve and Territorial Army, when they are called out.

The number of lectures proposed for the year, with the days, hours, time to be devoted to each subject, &c., is annually filled in by the Colonel on a printed form, and submitted to the Inspector-General.

Independently of this, however, special lectures may be given to Officers to make up for lost time.

Practical Instruction.—The practical training of a Regiment comprises—

1. Infantry drill and manœuvres.
2. Practical instruction of the cadres.
3. Field duties.
4. Target practice.
5. Marches and encampments.
6. Entraining and detraining.
7. Fencing, gymnastics, swimming, and riding.

Recruit drill takes place twice a day, but in the interval, instruction is given in the barrack-room on various Service rules and regulations.

Officers and non-commissioned officers detailed to instruct recruits are changed as often as it may be necessary, partly to increase the number of qualified instructors, and partly to enable them to attend to their own training. Recruit drill is carried on precisely as in the Infantry.

Squad and Company drill in close formation takes place annually for the whole Regiment, beginning, if the weather permits, on the 1st March. This is afterwards followed by Squad and Company drill in extended formation, and next by Battalion drill in close formation until a certain proficiency is acquired. The Battalions are also exercised on a few occasions in the open formation, so as to enable Officers and men to be familiar with the attack formation and combined action of the various échelons.

When Battalions have acquired a certain steadiness in Battalion drill, they are drilled by Captains; this also gives the Lieutenants the opportunity of acting as Captains and Adjutant-Major.

Brigade drill is sufficiently practised to enable Officers and men to be familiar with the movements of large bodies of troops, more especially for purposes of reviews and marching past.

The mornings of Wednesdays and Fridays are devoted to exercises in field duties.

Target practice may begin as soon as the Companies have done sufficient preliminary drill. It is always preceded by the *tir à tube*, or what is known at present in this country as practice with the Morris tube, carried out in the barrack-rooms and barrack-square.

The practical instruction of the cadres is carried out in accordance with the Ministerial Circular of the 15th December, 1876, but, of course, more especially in accordance with such portions as refer to the Engineers, special stress being laid on the taking up of positions.

All drills and exercises last two hours, exclusive of periods of standing easy, and the time taken in marching to and from the ground.

Certain forenoons of Wednesdays and Saturdays are devoted to practice in marching and encamping. The marches are made to apply as far as possible to the duties of the Engineers in the field, and are determined on, both as regards number and object, by the Inspectors-General. Encamping comprises bivouacking, pitching and striking tents, making kitchens, latrines, shelters, drains, &c. In all exercises in marching and encamping, non-commissioned officers and men always carry the field equipment they would on service.

Practice in entraining and detraining takes place every year at such times and places as are fixed by superior authority.

Fencing, gymnastics, and swimming are carried on as in the Infantry, fireman's duty being in addition taught as part of the gymnastic instruction.

Instruction in riding is given to such Lieutenants and Sub-Lieutenants as have not passed the *École d'Application*, by the Officers of the Company of Engineer Train with the horses belonging to the same.

Officers and men of the Reserve are given the same training in principle as the Engineers of the Active Army, only depending on the periods for which they are called out, determined on by the War Minister. Similarly

the Companies of the Territorial Army receive a like training, the Regiments of the Active Army furnishing the necessary instructional staffs.

Special Squads for Non-commissioned Officers.

These are special Squads (*pelotons d'instruction*) for soldier-candidates for the stripe (*candidats caporaux*), and corporal-candidates for the rank of *sous-officier* (*candidats sous-officiers*).

In the former, selected men are at once taken from the annual contingent and formed in a special squad in each Regiment, the number being fixed by the Colonel, and the candidates recommended by the Captains of Companies. A special Instructional Staff, struck off all other duties, is attached to the squad.

Volunteers and young men enlisting before the time of their liability to service are placed in the squad on joining, forming a special class by themselves. Young soldiers of the annual contingent may also, if they can read and write and know the first four rules of arithmetic, and are otherwise desirable men, be allowed to join this class after its formation.

The instruction begins as soon as the class is formed, and lasts till the *exercices de détail* commence.

After the *exercices de détail* are over, a special squad of corporal-candidates for the rank of *sous-officier* is formed in each Regiment. The numbers are fixed by the Colonel and based on the vacancies which are likely to occur at the end of the year. The candidates must be recommended by the Captains of Companies, but some may, as an exceptional rule, be selected from the special squad of candidates for corporals. The Instructional Staff is a special one, and is struck off all other duties. The squad is broken up on the 15th September of each year at the latest.

Both soldier-candidates (*élèves caporaux*) and corporal-candidates (*élèves sous-officiers*) live with their respective Companies; this rule being only modified under special circumstances. They are at the disposal of the Captains of their respective Companies when not actually under instruction. They take their share of garrison duties, being detailed for these by the Colonel so as not to interfere with their instruction. They are available as instructors to the Reserves, and take part in the annual autumn manœuvres.

Before a squad is broken up, the members are examined by a Board of Officers under the presidency of a *Chef de Bataillon*, detailed by the Colonel. The examination is a verbal one. The results are entered in the man's pocket ledger (*livret individuel*), together with the dates of joining and leaving the squad, &c., but no classification takes place in consequence.

Men may be dismissed the squad by the Colonel for misconduct or incapacity, on the recommendation of the Captains of Companies or the report of the squad instructors through the Lieutenant-Colonel.

Special or Technical Training (Instruction Spéciale ou d'Ecole).

There is a School of Military Engineering (*Ecole Régimentaire du Génie*) in each of the garrisons where there is a Regiment of Engineers (Versailles, Montpellier, Arras, and Grenoble).

Instructional Staff.—The Colonel is Director of the School, and, like a *Directeur du Génie*, is responsible for the expenditure of public money, and corresponds in such matters directly with the War Ministry.

A *Chef de Bataillon* of the Engineer Staff, with the title of "School Commandant," has administrative charge of the School and superintends all technical and practical instruction, except in such subjects as form part of the

regimental instruction, which is left to the *Chefs de Bataillon* under the Lieutenant-Colonel.

The School Commandant has charge of all stores, as well as the care and custody of the Engineer Parks attached to the school.

Two Officers of the Engineer Staff of the rank of Captain are attached (*Adjoints*) to the School Commandant as assistants; one at least of these must be a First Captain.

There are three civil professors in each school, one teaching grammar, history, and geography; another drawing, topography, and surveying; and a third mathematics and physics. They are under the immediate orders of the School Commandant.

There are two *Adjoints du Génie* (or Clerks of Works) under the immediate orders of the School Commandant. One has charge of all stores required for practical instruction and the Engineer Parks, and the keeping of the books and ledgers connected therewith (*comptabilité matières*). The other is employed chiefly in office work; he has charge of the library and model-room, and all furniture, &c., belonging to the school-rooms, and generally all stores required for theoretical instruction. He has charge of all accounts (*comptabilité finances*), and acts as treasurer in all school expenses. The former is assisted by an *Ouvrier d'Etat* or Foreman of Works.

The Lieutenant-Colonel, the *Chef de Bataillon*, and the other Officers of the Regiment, take a share in school instruction as laid down by the present regulations, and non-commissioned officers and men are detailed to assist the professors and *Adjoints du Génie* as circumstances require. On the application of the School Commandant such men may be more or less struck off guard-duty and duties for the week, by the Colonel, should he think it necessary.

Buildings, &c.—Every school is properly provided with the necessary buildings for technical instruction, such as class rooms and lecture theatres, a library, map and plan rooms, model and instrument rooms, a laboratory, &c.

There are also workshops for repairing the *matériel* and stores used for instructional purposes, making certain tools and appliances, and generally keeping the Engineer Parks in order.

The stores used for instructional purposes and those belonging to the Engineer Parks are kept distinct and in separate buildings.

In the winter two class rooms are lighted and warmed for voluntary study in the evening, one for *sous-officiers* and the other for corporals and sappers.

The library is open during certain hours to Officers, *Adjoints du Génie*, and Professors. Attached to it are reading and writing rooms. A third room should, when it is possible, be set apart for *sous-officiers*. A *sous-officier* of the Regiment is detailed by the Colonel as assistant librarian.

The model and instrument rooms contain sets of engineering instruments and appliances, and models illustrating details of fortification and other engineering works, the attack and defence of fortresses, railways, masonry brickwork, carpentry, &c.

Practice Grounds.—Every School of Military Engineering has a certain space of ground (*polygone*) for practical instruction in field works, &c. These *polygones* are exclusively for the use of the Engineers, and no other troops can use them without a formal order of the War Minister.

Every School has sets of surveying and levelling instruments, signalling apparatus, tools for sappers, miners, masons, carpenters, &c., mining frames and sheeting, timber for field works, bridging, shelters, &c., gabions, fascines, rails, and sleepers, and every other kind of store necessary for practical instruction. All these stores are exclusively employed for instruction, and both Colonel and School Commandant are responsible for this, and that they are not needlessly expended. The care, issue, &c., of these stores are laid

down in the Store Regulations for the Engineers (*Règlements sur la comptabilité-matières en vigueur dans le service du Génie*).

Theoretical Instruction.—This comprises—

1. The French language.
2. Mathematics and Physics.
3. Drawing.
4. Fortification and Military Engineering.
5. Geography.
6. French History.

Instruction for non-commissioned officers and men is divided into an elementary course comprising a certain number of classes given in the barrack rooms under the supervision of the Company Officers, and in secondary and superior courses, divided each into two divisions, given in the class rooms.

The number of attendances at each course, and the detail of Officers, Professors, and monitors to the latter, are annually fixed. Non-commissioned officers are detailed as monitors by the Colonel. The Officers are annually detailed as instructors by the Inspector-General on the recommendation of the Colonel.

Separate theoretical instruction in field fortification, siege works, bridging, and railways is given to *candidats sous-officiers* by the Company Officers, and to corporals and men qualifying for promotion, by the Company *sous-officiers*. This is under the supervision of the *Chefs de Bataillon*.

The above courses are obligatory on all non-commissioned officers and men, the classes being formed, without distinction of rank, of members possessing instruction of approximately the same degree.

Non-commissioned officers and men are annually divided into two categories by an examination held on the approach of the winter months. The first category comprises candidates for commissions, forming an advanced class; candidates for *Adjoints du Génie* or Clerks of Works, forming a second class; and *sous-officiers* and corporals candidates for promotion, a third class. The second category comprises men who do not aspire to promotion, or who are not considered sufficiently instructed for the rank they hold. They may, if they wish, be admitted to the third class just alluded to.

Theoretical instruction is, as a rule, carried on in winter, beginning on the 1st November and ending on the 1st March, but may take place when out-of-door work is interrupted by bad weather. Theoretical instruction in practical subjects should precede practical instruction in the same, independently of the time of year.

In the winter months theoretical instruction takes place every morning on week days.

The classes are annually arranged by the Colonel and submitted to the Inspector-General, showing the hours of attendance, &c., drawn up so as not to interfere with the ordinary duties of the Superintending Officers. Rules and regulations for dress, discipline, and other minor matters are left to the Colonel.

Professors and Officers make out returns on printed forms of all men that have passed through their hands. These returns, with the reports on the progress, intelligence, &c., of the men whose instruction they have supervised, are forwarded to the Colonel and by him eventually to the Inspector-General.

The *Chefs de Bataillon* make out returns in a similar manner of the men that have been practically instructed under their supervision.

No returns are made out for elementary instruction.

Finally the Colonel makes out a general return of all instruction given in the School and forwards it to the Inspector-General, and in addition a return

is made out for each man in which are entered the remarks of Captains of Companies concerning military duties and the instruction left to them.

At the end of the winter season an examination in school instruction takes place in the presence of the Colonel or Lieutenant-Colonel. The men are individually and verbally examined.

Theoretical Instruction of Officers.—The Officers of a regiment have annually to go through a course of theoretical mining and the attack and defence of places, under the School Commandant. Officers of known ability may be excused this, but the circumstance must be reported to the Inspector-General.

Encouragement is given by the Colonel to meetings for the discussion of professional subjects.

Lieutenants have annually to put together the notes, sketches, &c., they have made in the military reconnaissances which form part of their practical special training, to form a work of a topographical character. Officers of known ability may, however, be excused this by the Colonel.

Captains and Lieutenants have annually to investigate and treat certain professional questions or translate articles of professional interest in foreign languages, adding their own notes and observations. The subjects, &c., are given out by the Colonel.

The memoirs, essays, &c., written by Officers, are examined by the School Commandant, who submits them with his remarks (on a separate sheet of paper) to the Colonel. The latter again submits them to the Inspector-General, with his own and the School Commandant's remarks, calling attention to proof of ability or the reverse, as the case may be. Finally the Inspector-General calls the attention of the War Minister to such work as gives proof of undoubted ability.

Practical Instruction.—This is divided into five classes, viz. :—

1. Field Fortifications.
2. Sapping.
3. Mining.
4. Bridging.
5. Railways.

All men of the Regiment are put through these classes without distinction, but there are in addition the following classes reserved for special men only. These are—

6. Classification and packing of tools and stores.
7. Loading and unloading wagons and pack animals.
8. Pyrotechny.
9. Surveying.
10. Signalling.

Field fortification, sapping, and mining are followed by siege operations, above and below ground, and works to illustrate the attack and defence of positions in the fields. Every step is explained, the object of every work illustrated, and journals accompanied by the necessary drawings kept, as in actual warfare.

No other method of instruction than that laid down by Regulation (*Règlement sur l'Instruction des Régiments du Génie*, 25th June, 1885) is to be used under any circumstances, nor is instruction ever to be made the subject of experiment. Experiments are carried on separately, and are not to interfere with class instruction.

Instruction in the first five subjects above mentioned is carried on under the immediate supervision of Captains of Companies under the direction of the *Chefs de Bataillon*. All work is done by Companies, so that the men of

the Company work all together at the same kind of work under their own Officers and non-commissioned officers. All the Companies of a Battalion are put through the same class simultaneously.

There must be always present at least one of the Lieutenants per Company. The Captain is responsible that the instruction is properly carried out. The Second Captain acts as his assistant, but is in addition directly held responsible for tools and stores issued by the School of Military Engineering. The Officers belonging to the latter have again to see for themselves that these tools and stores are not unnecessarily expended or misapplied, and for this purpose visit the works as often as they may consider necessary.

Instruction in the classification and packing of tools and stores, and the loading and unloading of wagons and pack animals, is given to all non-commissioned officers, *maitres-ouvriers* (foremen-artificers), and soldier-candidates for the stripe, of the Regiment, by the Company Officers under the supervision of the Lieutenant-Colonel.

Instruction in pyrotechny is given to a certain number of selected men per Regiment. A *maitre-ouvrier*, chosen as a man having a turn for this kind of craft, is selected from each Company to undergo instruction. A *sous-officier* styled *Chef Artificier* acts as instructor to the class, which is under the supervision of one of the Captains-*Adjoints* of the School. The *Chefs Artificiers* are obtained by sending twice a year two corporals or young *sous-officiers* selected by the Colonel to the Central School of Pyrotechny at Bourges. In every Company all non-commissioned officers, and such sappers as are candidates for the stripe, receive from the Company Officers, whilst undergoing instruction in mining, a certain amount of training in the use of explosives, more especially as regards the firing of mines, &c.

Preliminary instruction in pyrotechny is given to Lieutenants and Sub-Lieutenants by the Captain-*Adjoint* already referred to.

The Surveying class is gone through by all the *sous-officiers* of the Regiment and such corporals as appear to have an aptitude for surveying. They are divided into Sections or "Brigades" according to their degree of knowledge. The instruction is carried on by the Professor of Surveying, who takes his orders direct from the School Commandant.

Practical instruction in surveying is arranged by direction of the Colonel so as not to interfere with other instruction.

Instruction in Signalling is given to a certain number of selected non-commissioned officers and men per Company. The Signalling class is under one of the Captains-*Adjoints*, who may be assisted by a Lieutenant and a staff of instructors. The hours of instruction are adjusted so as not to interfere with the practical training of the entire Company.

Siege Operations.—Siege operations take place annually, the whole Regiment taking part in them. They consist of the usual works connected with an attack *en règle* against a front of fortification, the nearer works of approach being executed whilst the further ones are traced only.

Certain Officers have also, in addition to this, to draw up projects for attack either on the place where the Regiment is quartered, or other places annually indicated by the War Minister.

Mining operations are annually carried out by groups of two Regiments, the Regiment at Versailles exercising every other year with the Regiment at Arras, and the Regiment at Montpellier every other year with the Regiment at Grenoble. When a Regiment is prevented from taking its turn in any given year, it makes up lost time by performing the exercises in the next two consecutive years, so as not to disturb the order of rotation. All Officers of the Regiment take part in these exercises, and a certain number of the Officers of the Regiments not exercising in the year are detailed to attend the exercises of the other Regiments.

Besides regular siege operations, the Regiment is exercised, as a whole, in hasty entrenchments and the attack and defence of positions in the field, both on its exercising ground and in the country in the vicinity, so far as it is possible.

Projects for the exercises in which the Regiment takes part as a whole are drawn up beforehand by the School Commandant and Lieutenant-Colonel, under the direction of the Colonel. The latter details both the Officers of the School and Regiment to certain special duties, and himself superintends the execution of the projects, the School Commandant acting as his Staff Officer.

Siege operations both above and below ground are accompanied by elaborate journals of operations, plans, and drawings drawn up by the Officers commanding the attack and defence.

The preliminary work of these exercises forms a subject of study, as a rule under a Field Officer of the Regiment. The report and proceedings are forwarded to the War Minister with the Colonel's remarks.

Practical instruction is carried on for the greater part in the summer season commencing 1st April, but it continues nevertheless during the winter months, weather permitting, for such men as are not under class instruction indoors. Work goes on every day in the week except Saturday, the spells lasting from three to four hours each. There are two such spells a day, except on Wednesday forenoon. The forenoons of Wednesdays and Saturdays are devoted to military drills and exercises.

Siege operations above ground take place night and day, the men working in reliefs as on service, but mining operations, as a rule, by day only.

Working parades are under the Lieutenant-Colonel. The Companies are marched to and from work by the Company Officers.

A programme for practical instruction during the summer is annually submitted by the Colonel to the Inspector-General. The number of attendances at each class is fixed as a maximum. The Lieutenant-Colonel submits every Saturday to the Colonel a detail for the work in the ensuing week, showing the distribution of the Companies, &c. This detail is afterwards made known to all the Officers of the Regiment.

Companies receive their tools and stores from the *Adjoint du Génie* in charge of stores. A general inventory of all stores takes place once a year. Every Company is responsible for the stores issued to it, and the losses that cannot be satisfactorily accounted for must be made good by it.

Distribution lists, showing the work done, the number of men present, &c., are kept by Lieutenants of Companies. These lists are examined by the Captains of Companies at the end of every week and submitted, with their remarks, to the Colonel. The Lieutenant on duty for the week makes out another special return or list. The Second Captain makes from the Lieutenants' lists a weekly return showing the work done by the Company, and finally, on completing each class of instruction, a general return is made from these and submitted to the *Chef de Bataillon*.

These journals and returns all eventually find their way through the Colonel to the Inspector-General.

A similar procedure is observed by the Professor of Surveying and the Officers Instructors of Pyrotechny, Signalling, &c.

Entries are made in the pocket ledgers of non-commissioned officers and men by Captains of Companies and the School Commandant, showing their degrees of instruction in every branch.

Special or Technical Instruction of Officers.—All Lieutenants, with the exception of such as are excused by the Colonel, go through an annual course of surveying and reconnaissance. From the notes and sketches they have made, they prepare certain maps and memoirs already alluded to.

The periods devoted to such work are so arranged by the Colonel that other practical work is as little interfered with as possible, and that the Officers are given sufficient time to have their drawings, &c., finished a month before the General Inspection.

Besides these exercises, Lieutenants are detailed to make sketches and road reports whenever marches are practised. These must be in the Colonel's hands with the next day's reports, at the latest.

Lieutenants go through an annual course of practical instruction under the Captains-*Adjoints* of the School in such pyrotechny as is more immediately concerned with military engineering, and in signalling. Instruction is also given them by the Captain-*Adjoint* in charge of stores, and the Captain Commanding the Company of Engineer Train, in the classification and packing of tools and stores, the loading and unloading of wagons and pack animals, and the classification and use of harness and saddlery and matters connected with transport generally.

Captains and subalterns are annually formed into "brigades" and practised in tracing parallels and approaches by night and day under the *Chefs de Bataillon*, the work forming a special subject of study by the senior Officers concerned beforehand. The whole is under the general supervision of the Lieutenant-Colonel.

Finally, the Colonel has to see that no opportunity is lost of affording Officers the means of perfecting themselves in such practical work as they would be called upon to perform in all the phases of a campaign.

Instruction of Officers and Men of the Reserve and Territorial Army.

Officers and men of the Reserve, when called out for training, are put through a course of practical instruction agreeably with the Ministerial decisions of the 2nd May, 1878, and 19th March, 1879, special instructional staffs being detailed for their benefit.

Territorial Companies of Engineers are put through a course under their own Officers under the supervision of a *Chef de Bataillon* of the Regiment, according to programmes issued from time to time by the Minister of War (see Circular of the 20th March, 1879).

To enable the Engineer Regiments to follow without interruption their technical training, they are not called upon to perform garrison duties unless the Infantry and Cavalry quartered in the place are not sufficient for the purpose. Before commencing any particular course of instruction out of doors, the Colonel makes certain necessary arrangements with the Officer Commanding the garrison as regards times and places of assembly, &c., and the latter has to make such arrangements as regards garrison duties as shall interfere as little as possible with the training of the Engineers.

The Colonel makes his own arrangements for the training of the Company of Engineer Train and the section *hors rang* of regimental tradesmen, according to the principles observed in the general training of the Regiment.

A section of 2 sergeants, 4 corporals, and 30 sappers belonging to the *Depôt* Company and selected for their knowledge of the trades concerned, throughout the Regiment, are permanently employed in the workshops of the School, both in keeping the tools and stores used for instructional purposes in repair, and making and keeping in repair the stores of the Engineer Parks belonging to the School. These men must all have done at least one year's practical instruction. They are struck off all duties, and only attend to certain drills and military exercises.

Besides these men permanently employed, a certain number of selected men are detached from their Companies for employment in the workshops, so as to acquire the knowledge necessary for keeping the tools and stores of

the Company Parks in the field in repair. They are detailed by the Colonel, so that the employment may not interfere with their other technical and military training.

No non-commissioned officer or sapper is allowed to undertake private work, but may under certain circumstances be employed by the *Génie de Place*, or what we should call the "Royal Engineer Department."

Non-commissioned officers and sappers who distinguish themselves for zeal and ability are mentioned in orders at the end of every quarter. Their names also appear in conspicuous places in the School during the following quarter. A note is made of this to govern future promotion.

On passing into the Reserve, certificates of proficiency in the various kinds of training may be given, on application, by the Colonel. Similarly the School Commandant may give certificates to the men who have been employed in the workshops.

The courses, classes, and the number of attendances every man has attended are inserted at the end of every year in his pocket ledger.

Certain limits are allowed within which the Colonel may modify the present Regulations (of 25th June, 1885), but all deviations are to be reported at the General Inspection.

Elaborate programmes are annually made out by the School Commandant on all theoretical, practical, special, or technical training during the ensuing year, as well as on the care of the military *matériel* in charge of the School, with the expenses likely to be incurred in keeping it in repair. He may be assisted in drawing up these reports by certain Officers of the Regiment detailed by the Colonel.

Briefly, these reports are divided into three chapters—the first devoted to theoretical instruction, the second to practical instruction, and the third to the care of military *matériel*. These chapters are divided into articles, and again subdivided, when necessary, into sections. These reports contain the estimates for the ensuing year, and where the expense cannot be shown under any of the chapters, it forms the subject of a special chapter.

To these are attached special programmes for siege operations and experiments. Experiments with their estimated expense form a special chapter.

A special chapter is also devoted to stores of all kinds required for the ensuing year.

All these programmes, accompanied by the necessary drawings, estimates, &c., must be in the hands of the Colonel before the 31st December, and in the hands of the War Minister before the 1st February.

A summary of the programme is also forwarded by the School Commandant and *Directeur du Génie* through the Commanding Engineer (*Commandant du Génie*) of the District to the Inspector-General. The latter decides on the work that is to be executed.

All work connected with the repair and maintenance of existing works, buildings, exercising grounds, &c., as well as the construction of new works and buildings, is left to the *Génie de Place*.

As regards the current school expenses, the School Commandant holds the same financial position as a *Chef du Génie*, or Commanding Engineer.

THE ENGINEERS WITH THE ARMY IN THE FIELD.

The Engineer Staff.

The 18 French Army Corps would, in case of war, be most probably formed in some 4 or 5 Armies of from 3 to 5 Army Corps and 1 or 2 Cavalry Divisions each. To the Headquarter Staff of an Army there would be a Commanding Engineer—a General Officer—with a Staff, an Army Engineer Park, an Army Bridge Train, a Technical Railway Section, and a Railway

Company and Park. Details, however, are wanting on the composition of Army Staffs.

The Engineer Staff of a mobilized Army Corps would comprise a Brigadier-General or Colonel of the Engineer Staff as Commanding Engineer, a *Chef de Bataillon* as Executive Officer, a *Chef de Bataillon* as Park Director, 2 Captains of the Engineer Staff, 2 *Adjoints du Génie*, and 2 clerks, with 1 one-horse baggage cart, 1 two-horse office and provision cart, and 2 drivers, 7 servants, and 16 horses; or 6 Officers, 11 non-commissioned officers and men, 16 horses, and 2 wagons in all.

The Engineer Staff of a mobilized Division would comprise a *Chef de Bataillon* only, with 1 servant and 2 horses.

In the case of siege operations a special Engineer Staff would be appointed to each attack, &c.

To the Staff of the Commander-in-Chief of two or more Armies would be attached a General Officer of Engineers of high rank as Inspector-General of Engineers. He would be assisted by a Staff of Engineer Officers, but no details for this are apparently laid down.

A mobilized French Army Corps is a copy of the German. Briefly it comprises the following :—

- An Army Corps Headquarter Staff.
- 2 Infantry Divisions complete.
- A Battalion of *Chasseurs à Pied*.
- A Cavalry Brigade.
- The Corps Artillery.
- The Corps Artillery Park.
- A Train Squadron.
- A Corps Ambulance.
- A Provision Column.
- A Telegraph Section.
- A Company of Pontoneers with Bridge Train.
- An Engineer Company and Corps Park.
- A Horse Dépôt.
- A Train Dépôt, &c.

The total ration strength of Army Corps is—

- 10 General Officers.
- 947 Officers.
- 35,107 Non-commissioned officers and men.
- 9,678 Horses.
- 1,759 Carriages.

The fighting strength is 25 Battalions of Infantry and *Chasseurs à Pied*, 8 Squadrons of Cavalry, 16 Batteries of Artillery, 2 Companies of Engineers, and a Bridge Train, comprising—

- 24,820 bayonets.
- 1,200 sabres.
- 96 guns.

Engineer Troops.—Sapper Companies.

Although there is nominally a Battalion of Engineers of 4 Companies to an Army Corps, only 2 Companies would belong to it in the field. One of these would be divided in 2 Half Companies, attached to the Divisions. The other Company would be kept in reserve.

The war strength of a Company is laid down as : 2 Captains, 2 subalterns, 1 Reserve Officer, 1 sergeant-major, 1 quartermaster-sergeant, 10 sergeants, 16 corporals, 6 *maîtres-ouvriers* or foremen artificers, 2 buglers, and 186 sappers.

The Park of a Company comprises 2 four-horse Engineer store wagons, 2 pack animals, 2 one-horse baggage carts, and 2 one-horse provision carts, with a detachment of the Engineer Train of 10 drivers, and 2 riding, 8 draught, and 2 spare horses. The baggage and provision carts would be drawn by requisitioned horses and driven by men of the Company. This is exclusive of Officers' horses.

There are 100 Company Parks, 20 being in reserve.

The Half Company, with its Half Company Park attached to a Division, forms the *Génie Divisionnaire*. This, with the *Chef de Bataillon* or Commanding Engineer of the Division, comprises altogether 4 Officers, 126 non-commissioned officers and men, with 8 riding, 4 draught, and 1 spare horses, 1 pack animal, and 3 wagons and carts.

The Company kept in reserve is accompanied by its Park complete.

There is in addition to every Army Corps a Reserve Park or *Parc de Corps d'Armée* in addition. It is under a Park Director on the Army Corps Staff. The Park comprises a detachment of Engineer artificers of 3 non-commissioned officers and 6 sappers, and a detachment of 3 non-commissioned officers, 1 trumpeter, 2 shoeing smiths, and 46 drivers of the Engineer Train, with 6 riding, 68 draught, and 5 spare horses. The carriages are 7 large six-horse covered tool wagons, 2 ordinary six-horse store wagons, 1 four-horse field forge, 1 four-horse dynamite wagon, and 1 four-horse forage wagon, or 12 carriages in all. The large wagons carry all kinds of Engineer tools and appliances, one of the ordinary store wagons rope and bridging gear, and the other portable Engineer or Infantry tools. There are 20 (19?) of these Parks.

An Army Engineer Park (*Parc d'Armée* or *Grand Parc du Génie*), of which there are 4, comprises an Engineer detachment and 2 Companies of Military Train. The Engineer detachment consists of an *ouvrier d'Etat* (see p. 1191), 3 non-commissioned officers, and 15 sappers. The carriages are as follows:—28 wagons carrying sappers' tools and appliances, 2 carrying portable Engineer or Infantry equipment, 2 carrying portable miners' tools, 3 carrying small tools, stores, and appliances, 3 carrying sand-bags, 1 powder wagon, 3 dynamite wagons, 1 wagon carrying a derrick and appliances, 2 field forges, 4 wagons carrying ropes, &c., for bridging, 2 pontoon wagons carrying boats, 2 do. carrying trestles, 3 wagons carrying piles, and 1 carrying a pile-driving machine; or a total of 58 carriages, of which 45 carry Engineer, and 13 bridging, stores. There are besides 6 wagons for the 2 Train Companies, consisting of 2 field forges, 2 store wagons, and 2 forage wagons, giving a total of 64 carriages in all.

The total Park would comprise some 10 Officers, 262 non-commissioned officers and men, 415 horses, and 64 (or according to some accounts 66) carriages.

The total number of Engineer Parks are then :—100 Company Parks, of which 3 would be required per Army Corps at the outset, or 57 in all, 20 (19?) Army Corps Parks, and 4 Army Parks. The *matériel* of all these Parks is equally distributed and kept in store at the four Schools of Military Engineering.

The following Table shows the various tools carried.

| | In an Army Park. | In an Army Corps. | | | In a Division. | |
|---|------------------|-------------------------|--|--------------------------------------|------------------------------------|---|
| | | In the Army Corps Park. | On the wagons of the Company Parks. ¹ | Carried by the men of the Companies. | On the wagons of the Half Company. | Carried by the men of the Half Company. |
| Shovels | 4,200 | 1,050 | 400 | 100 | 100 | 25 |
| Spades | 806 | 172 | 8 | .. | 2 | — |
| Pickaxes | 2,135 | 530 | 200 | 100 | 50 | 25 |
| Picks | 436 | 35 | 12 | .. | 3 | — |
| Axes, felling | 805 | 175 | 32 | .. | 8 | — |
| Axes, hand | 163 | 35 | 16 | 76 | 4 | 19 |
| Billhooks | 1,284 | 315 | 60 | 24 | 15 | 6 |
| Saws | .. | 28 | 24 | 4 | 6 | 1 |
| Chain saws | 20 | .. | .. | 4 | .. | 1 |
| Smiths' tools, sets | 400 | .. | .. | 12 | .. | 3 |
| Carpenters' tools, sets | 650 | .. | .. | 28 | .. | 7 |
| Chests with miners' and quarrymen's tools | 10 | .. | 8 | .. | 2 | — |
| Chests with ropes, bridging gear, lighting apparatus, &c. | 16 | 4 | 4 | .. | 1 | — |
| Wagon poles | 30 | 4 | 4 | .. | 1 | — |
| Powder (kil.) | 400 | — | — | — | — | — |
| Dynamite (kil.) | 900 | 300 | 175 · 20 ¹ | .. | 43 · 8 ¹ | — |

¹ Carried on pack animals.

The total entrenching tools with a Division is then 125 shovels, 2 spades, 75 pickaxes, 3 picks, 8 felling axes, 23 hand axes, 21 billhooks, 7 saws, 1 chain saw, 3 sets of smiths' tools, and 7 sets of carpenters' tools.

The total entrenching tools with an Army Corps would be 1,550 shovels, 180 spades, 830 pickaxes, 47 picks, 307 felling axes, 127 hand axes, 399 billhooks, 56 saws, 4 chain saws, 12 sets of smiths' tools, and 28 sets of carpenters' tools.

The portable equipment, which is always carried on service, is equally distributed in the Half Companies to make these independent.

Engineer Troops—Railway Companies.

The war establishment of a Railway Company is laid down as : 2 Captains, 4 Subalterns, 1 sergeant-major, 4 quartermaster-sergeants, 16 sergeants, 22 corporals, 2 buglers, and 247 sappers.

Like Sapper Companies, Railway Companies are organized to be used as independent Half Companies.

To each Half Company would be attached in war the following detachment of Engineer Train and Park : 1 sergeant, 2 corporals, 1 shoeing smith, and 20 drivers, with 4 riding horses, 26 draught horses, and 2 spare horses, and 1 four-horse Engineer tool wagon (the same as in the Sapper Company Parks),

2 four-horse Engineer wagons for carrying sappers (*sapeurs montés*),¹ 1 four-horse powder and dynamite wagon, 1 six-horse large tool and implement wagon, 1 four-horse field forge, besides 2 one-horse baggage carts, and 1 two-horse provision cart; in all, 24 non-commissioned officers and men, 18 carriages, and 32 horses. The baggage and provision carts would be drawn by requisitioned horses, and driven by men of the Half Company. There are 20 Half Company Parks. The *matériel* of these is kept in store at the four Schools of Military Engineering.

CLOTHING, ARMS, AND ACCOUTREMENTS.

The uniform of the French Engineers is much the same as that of the Artillery, except that the facings are of black velvet, and, instead of the crossed guns, they wear a coat of arms on the shako, buttons, &c. The tunic, great coat, and shell jacket are dark blue, with the number of the Regiment on the collar. The trousers are dark blue with a double red stripe as in the Artillery. The shako is dark blue, and has red chevrons as in the Artillery. The Sapper Companies wear a red pompon, but the Train Companies a red horsehair plume. The képi is dark blue with red piping. The belts are black, and the buttons yellow. Dismounted men wear low shoes and gaiters, white in summer, leather in winter. Mounted men wear half-boots and booted overalls of the well-known French cavalry pattern. The men of the Railway Companies wear a small railway engine worked in red worsted on the right arm.

The Sapper Companies are armed with the Infantry rifle and sword bayonet. Train soldiers are armed with Cavalry swords and revolvers. Adjutants, non-commissioned officers, sergeant-majors, and bandsmen wear a straight dress sword. Men armed with rifles carry 78 rounds in the field—36 rounds in two pouches on a waistbelt, and the remainder in the pack.²

The sapper carries the same iron rations as the Infantry soldier. These are two rations of biscuit or bread, preserved meat or salt pork, salt, sugar, preserved vegetables, coffee, &c.

Two days' similar rations are carried in the Company provision carts.

The iron rations are not supposed to be touched without an order.

Wine or spirits are only served out by order of the General Commanding.

SERVICES SOMETIMES CONNECTED WITH THE ENGINEER ARM.

RAILWAYS.

The French Railway Organization with its serious drawbacks has already been described in vol. xxix, No. CXXVIII, page 251 of the Journal under the heading of the French Railway Corps.

CARRIER PIGEONS.

This is practically an Engineer service in the French Army. It has been fully described in an article by Captain H. T. W. Allatt in vol. xxx, No. CXXXIII (1886), page 107 of the Journal.

BALLOONING.

Balloonning, with carrier pigeons, the electric light, and other means of communicating messages through the air, all come under the *Commission des*

¹ Probably intended to carry Sapper Detachments to accompany Cavalry Divisions.

² French ammunition is made up in packets of six rounds.

Communications par Voie Aérienne, which is under the Director of the Fortification Dépôt, the Sub-Director of the same acting as President. They may all be practically considered as Engineer services, but as yet, with the exception of the pigeon service, nothing is known as regards any of them being placed on an organized military footing.

PART III.—THE PONTONEERS.

Peace Organization.

The Pontoneers of the French Army belong to the Artillery. When the Law on the reorganization of the Army was passed in 1875, this was a question that gave rise to considerable discussion, the Engineers claiming it as a branch of their service. That it was rightly an Engineer service was hardly denied, but the objection of the Artillery to part with it, based mainly, if not entirely, on questions of promotion, carried the day in the end.

It must be generally admitted that the present arrangement is a very faulty one.

There are two Regiments of Pontoneers, styled *Régiments d'Artillerie-Pontonnières*, numbered 1 and 2, and stationed at Avignon and Angers, in the 15th and 9th Army Corps Districts, respectively.

Each Regiment comprises a Staff and 14 Companies. The 1st Regiment has a Company detached in Algeria.

In war the Regiment would be broken up, and the Companies distributed to Armies and Army Corps, as will be shown further on.

The Staff of a Regiment comprises a Colonel in command, a Lieutenant-Colonel, 3 *Chefs d'Escadron*, a Major, a Paymaster (Captain), an Assistant Paymaster (Subaltern), a Clothing Officer (Captain), 2 Surgeons, and a Veterinary Surgeon. The *Petit Etat Major* and *Section Hors Rang* of the Regimental Staff comprise: 4 Adjutants (non-commissioned officers), 4 foremen-artificers, 1 sergeant-major, 8 sergeants, 1 quartermaster-sergeant, 7 corporals, 2 trumpeters, and 12 privates.

The total Regimental Staff is 12 Officers, and 39 non-commissioned officers and men, with 20 riding horses.

The Company Officers of a Regiment are 14 First Captains, 14 Second Captains, 14 First Lieutenants, and 14 Second Lieutenants.

The 1st Regiment had at the beginning of the present year 1 First Lieutenant and 13 Sub-Lieutenants in the Reserve, and the 2nd Regiment 1 First Lieutenant and 18 Sub-Lieutenants in the Reserve.

The Officers serving are borne on the general list of the Artillery.

The *effectif budgétaire* of the Pontoneers is 156 Officers and 2,930 non-commissioned officers and men.

War Organization.

On mobilization each Army Corps would receive a Company of Pontoneers, and the remaining Companies would be attached to Armies or formed in Reserve.

The Bridge Train of a mobilized Army Corps would comprise a Company of Pontoneers and a Company of Artillery Train (belonging to the Artillery Brigade of the Army Corps), by which the Train would be horsed.

The Bridge Train of an Army would comprise a Company of Pontoneers and two Companies of Artillery Train, forming two Army Corps Bridge Trains.

The war establishment of a Company of Pontoneers is laid down as:

2 Captains, 3 subalterns, an Adjutant (non-commissioned officer), a sergeant-major, 8 sergeants, 1 quartermaster-sergeant, 7 corporals, 12 foremen artificers, 2 trumpeters, and 124 privates; or 5 Officers, 156 non-commissioned officers and men, and 7 horses.

The war establishment of an Artillery Train Company would be: 3 Officers, 174 non-commissioned officers and men, and 300 horses.

The total strength of an Army Corps Bridge Train would then be: 8 Officers, 330 non-commissioned officers and men, and 307 horses.

An Army Bridge Train would be commanded by a Field Officer of Pontoneers, and attached to him would be a Reserve Officer, a Surgeon, and a Veterinary Surgeon. The total establishment would be 15 Officers, 505 non-commissioned officers and men, and 612 horses.

The Senior Pontoneer Officer is always in command.

An Army Corps Bridge Train is divided into 2 sections and a reserve. Each section comprises 10 pontoon wagons, 7 general store wagons, and a field forge. The Reserve comprises a pontoon wagon and a general store wagon. The total number of wagons in the Bridge Train is 38, all six-horsed, besides a field forge, 2 general store wagons, 6 provision wagons, and a forage wagon, making the total number of carriages 47 in all.

The bridging stores carried are 16 pontoons, 4 trestles, and 2 rowing boats, and the total length of bridge that can be thrown is 64 metres.

The length of bridge that can be thrown by an Army Bridge Train is double this, or 128 metres.

Bridging Material.

As Pontooning is an Artillery service we do not propose to describe the bridging *matériel* in detail.

The pontoon used is a wooden boat of the 1855 pattern. It is built of pine strengthened with ribs and knees of oak. It is 30 feet 10 inches long, 5 feet 9 inches wide at top, 4 feet 4½ inches wide at bottom, 2 feet 10 inches high at the stern, 2 feet 7 inches high at the bow, and 2 feet 7 inches high amidships. Its weight is 1,450 lbs., and sinking load 18,700 lbs. It draws, with ordinary superstructure, 1 foot 7½ inches of water, and can carry 25 infantry soldiers in marching order.

The rowing boat is built of the same material as the pontoon, but is much smaller.

The trestle is of the Birago pattern, with long and short legs, and oak soles to prevent sinking. The baulks are of two kinds, ordinary and cleated, as in the Birago bridge equipment. The length of a bay from centre to centre of pontoons is 19 feet 6 inches, and the length between bearings 14 feet. There are seven baulks in a bay, besides two used as ribands. The shore-end bay is 17 feet 6 inches long, and the clear bearing of baulks 13 feet 5 inches.

The length of a trestle bay is 18 feet, and the clear bearing of baulks 17 feet 8 inches.

This is the ordinary bridging, or *pontage à petite portée*. It can take Infantry in fours, Cavalry in twos, and Field Artillery. For Siege Artillery and exceptionally heavy loads the bays would be reduced in length, and the number of baulks increased.

The roadway is 9 feet 6 inches wide in the clear.

The bridging parties are 12 non-commissioned officers and 85 men using pontoons only, and 13 non-commissioned officers and 97 men using pontoons and trestles.

NOTICES OF BOOKS.

Napoleon als Feldherr. By GRAF YORCK V. WARTENBURG. Zweiter Theil. Berlin. Mittler. Pp. 424. Size 8 $\frac{3}{4}$ " x 6" x 1". Weight under 1 $\frac{1}{2}$ lbs. Price, 2 vols., 17s. 6d.

We greet with pleasure the appearance of the second part of this work.

Although not always in accord with the author's conclusions, we recognize with satisfaction the care with which he has carried out the plan of criticism sketched out in the first part, and with which the divisions of this further study of the military career of the Emperor Napoleon have been treated.

In this issue he discusses successively the campaigns of 1808 in Spain; of 1809 in Germany; of 1812 in Russia; of 1813 in Germany; of 1814 in France; and the final catastrophe in 1815.

The issue of this part is completed by two maps; one of the passage of the Danube at the island of Lobau, the other of the scene of operations in Russia in 1812.

While the first part depicted the rise and growth to the highest pitch of the great and successful warrior, the second treats of the further progress of his ambitious career, of the gradual weakening of his personal conduct of the operations of war, and of his subsequent and irretrievable eclipse.

There is much to be learnt by all leaders of troops or students of military history from a so careful consideration of these different phases of Napoleon's career.

In the first of the three periods he was great as a tactician, and unrivalled as a strategist; in the second, great as were his strategical successes, he was hindered and encumbered by his political position; in the third and last these difficulties were not only greatly increased, but with gradual weakening of his mental, certainly of his physical powers, his obstinate self-will led him too frequently to act, not as the circumstances plainly dictated, but as he chose them to appear.

Further than this the author points justly to the fact that the personal direction of operations by one man, who solely and alone conducts both the strategical and tactical operations, can only continue to be successful so long as his personal activity continues unweakened, and does not lead to the formation of subordinate leaders who can be absolutely reliable when distant from the directing hand.

Other causes may also be quoted as leading to Napoleon's downfall. The very honours and wealth which he had heaped on his subordinates had led to self-indulgence, to unwillingness to undergo the exhaustion and hardships of war, the success of which was, to say the least, doubtful, and to impatience of a leading which, from his constant change of plan, led to harassing marches and counter-marches.

The author further points out that the enormous scale on which the later campaigns were carried out, actually prevented that intimate personal and tactical direction which was so eminent a factor in Napoleon's earlier campaigns; and from this he draws deductions affecting the operations of the present day, with which we can only cordially agree.

One cause of the failure in Russia, also to a minor degree of the difficulties in Austria in 1809, is only lightly alluded to by the author. We advert to the weakening of discipline so graphically portrayed by de Fézensac and Brand; to the horrible plundering and destruction which was inevitable on the deficiency of regular supplies, and to the terrible necessity, therefore, of a retreat through an already devastated hostile country.

We cordially recommend this most creditable work of a thoughtful Officer of junior rank to the perusal of those who look upon the study of our profession as about the most profitable employment of leisure hours to which an Officer can devote himself.—C. B. W.

The Naval Annual, 1886. By Lord BRASSEY, K.C.B. Griffin, Portsmouth, 1886. Pp. 550. Size 10" \times 7" \times 2". Weight under 3 lb. 8 ozs. Price 7s. 6d., post free. London Agents, Simpkin, Marshall, and Company.

This is the first appearance of a publication which is intended to be an annual; and the object of which is to bring together a large amount of information on naval subjects which has hitherto been obtainable only by consulting numerous publications chiefly from foreign sources. The compiler in his short preface earnestly invites the co-operation of naval and professional men. It seems almost needless to say that the book is worthy of the source from which it emanates. It supplies a want keenly felt hitherto.

Colonial France. By C. B. NORMAN, late 90th Light Infantry. Allen, London. 1886. Pp. 331. Size 9" \times 6" \times 1½". Weight under 2 lbs. Price 15s.

An interesting history of French Colonization brought down to the present time. The author also considers this question in relation to ourselves.

La Tactique au XIII^{me} Siècle. Par HENRI DELPECH. Paris, Picard, 1886. 2 vols. Pp. 842. Size 10" \times 6½" \times 2". Weight 3 lbs. 2 ozs. Price 10s.

This is an extraordinary work. The author has spent eleven years in compiling a most erudite publication for the purpose of demonstrating that 600 years ago there existed in armies tactics of each arm, and also *La Grande Tactique*. The tactics of the thirteenth century are hardly matters with which a nineteenth-century soldier has much to do, but nevertheless no one can fail to read with great interest the result of M. Delpich's profound researches, which bring vividly before the eye the minutest details of the warfare of a period, when cavalry were, in the author's opinion, the chief arm, and infantry but auxiliary to it. The work will well repay perusal.—L. A. H.

Précis Politique et Militaire des Campagnes de 1812 à 1814. Extrait des Souvenirs inédites du Général Jomini. Par F. LECOMTE, Colonel Fédéral Suisse. "Nouvelle Revue," Paris, 1886. 2 vols. Pp. 651. Size 9½" \times 6½" \times 1½". Weight 2 lbs. 10 ozs. Price 16s.

A valuable contribution to our stores of military history. The memoir of Jomini, which precedes the *Souvenirs*, is very interesting, and certainly elicits sympathy with a chequered and not altogether successful career.

Experiences of a Woolwich Professor. By Major-General A. W. DRAYSON. Chapman and Hall, London, 1886. Pp. 312. Size 8¼" \times 5¼" \times 1½". Weight 1 lb. 7 ozs. Price 8s.

This book contains, besides the autobiographical reminiscences, some thoughtful remarks on education. We almost wish that the astronomical chapters had been omitted, as they are hardly experiences special to a "Woolwich Professor."

English Worthies. Edited by ANDREW LANG. *Admiral Blake*. By DAVID HANNAY. Longmans, London, 1886. Pp. 190. Size 7½" \times 5" \times 3½". Weight under 12 oz. Price 2s. 6d.

A well written and excellent little biography of one of England's greatest naval heroes.

India under British Rule from the foundation of the East India Company. By J. TALBOYS WHEELER. Macmillan, London, 1886. Pp. 302. Size 9" \times 6" \times 1". Weight under 1 lb. 1 oz. Price 12s. 6d.

This book contains a good succinct account of what its preface and title professes it to be. The last chapter is an exceedingly useful one in describing precisely the changes that have taken place under the various Governments of India since that

Government passed to the Queen. From the fact that the author has held high appointments in India, which must have given him opportunities of consulting the best authorities on the subjects of which he writes, it is probable that for its size the book may be considered one of the best and most concise works on the subject that has appeared for some time past, and it will be found very useful for educational as well as general reading.—M. G.

Fifteen Years of Army Reform. By an OFFICER. Blackwood, London, 1884. Pp. 88. Size $8\frac{1}{2}'' \times 5\frac{3}{4}'' \times \frac{1}{2}''$. Weight under 10 ozs. Price 2s. 6d.

Although published two years ago, this *brochure* has only just been sent for notice. The weak points in the reforms adopted are exposed with great ability; but unfortunately the tone of the work is so bitter and so one-sided, that in reading it we seem involuntarily to come at once to the conclusion that the case put forward by "an Officer" is greatly overstated. Had "an Officer," carefully avoiding personalities, temperately pointed out the errors committed, he would have done good service. As the book stands it is a brief for the non-reformers.

Campagne du Nord en 1870-71. Par PIERRE LEHAUTCOURT. Lazauville, Paris, 1886. Pp. 255. Size $10'' \times 6\frac{1}{2}'' \times 1''$. Weight under $1\frac{3}{4}$ lbs. Price 3s.

This book is a most valuable contribution to the literature of the Franco-German War. It is temperate in style, and so far as we can judge accurate and reliable. It forms a pleasing contrast to much of the so-called histories drawn up by French writers. It is to be hoped that this volume is but the first of a series of similar monographs. The author has brought to his task a determination to be unbiassed by political or other disturbing considerations, and to state facts as they occurred, and not merely as his countrymen would like to see them represented. We know this war pretty well from a German point of view; at last we are about to see that war in a less one-sided aspect.—L. A. H.

The Autobiography of Serjeant William Lawrence, a Hero of the Peninsular and Waterloo Campaigns. Edited by G. BANKES. Sampson Low, London, 1886. Pp. 250. Size $7\frac{1}{2}'' \times 5\frac{1}{4}'' \times 1\frac{1}{2}''$. Weight under 1 lb. 2 ozs. Price 6s.

This book was composed by a man who could not write, and who dictated his experiences to a fellow servant. Of these materials Mr. Bankes has undertaken the editorship. Any record of personal experience of the ranks in old days cannot fail to be of interest, but the preface leads us to expect rather more than we find in the narrative.

Wars of Queen Victoria's Reign, 1837-87. By the Hon. Mrs. ARMYTAGE. Sampson Low, London, 1886. Pp. 254. Size $7\frac{1}{2}'' \times 5\frac{1}{2}'' \times 1''$. Weight under 1 lb. 2 ozs. Price 7s. 6d.

A very useful and concise war diary of the Empire.

Ranks and Badges, Precedence, Salutes, Colours, and Small Arms in H.M. Army and Navy and Auxiliary Forces, including a Record of the Military and Naval Forces in the different Countries of Great Britain and Ireland. By Lieut. O. L. PERRY, 2nd Vol. Bat. L.N. Lancashire Regt. Clowes, London, 1887. Pp. 416. Size $6\frac{1}{2}'' \times 4\frac{1}{2}'' \times 1\frac{1}{2}''$. Weight under 1 lb. Price 6s.

This work is the outcome of a vast amount of industry and research, and contains much interesting and valuable information difficult to find elsewhere. It would be a desirable addition to all military libraries.

Vice in the Horse, and other Papers on Horses and Riding. By E. L. ANDERSON. Douglas, Edinburgh, 1887. Pp. 70. Size $9'' \times 6'' \times \frac{1}{2}''$. Weight under 12 ozs. Price 5s.

There is not in this book much, if anything, more than is learnt by going through

the ordinary course in a military riding school. Cross country riders may possibly look down on such a course, but a perusal of Mr. Anderson's work may perhaps show them that even their style of riding might be benefitted by knowing how to make full use of the "aids" employed in military equitation.—D.

Battalion Drill Made Easy. By W. GORDON.

Messrs. Gale and Polden, of Chatham, are continuing the publication of their series of useful military works. Vol. 23 is a "Guide to Court Martial Procedure," by Lieut. C. G. Morrison, Rifle Brigade; vol. 19 is the "Officers' Pocket Book;" vol. 26 is "The Sergeants' Pocket Book;" vol. 27 is "Battalion Drill Made Easy," the last three being by W. Gordon, 2nd Battalion Gordon Highlanders, late Sergeant-Major 2nd Battalion Scots Guards. The prices of the works, which are all small, are 1s. 6d., 2s. 6d., and 2s. and 3s. 6d. respectively, post free.

Messrs. Gale and Polden have also issued a guide to Army Signalling by Lieutenant Eales of the Buffs. Price 6d., or 5s. per dozen, post free.

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| RICHARDSON, COL. J. B., R.A. .. | The Weldon Range-Finder | 501 |
| SALE, MAJOR C. M. G., R.E. | On Land Mines | 95 |
| SEYTON, W. (The Late) | Electric Guns and Ammunition (Russell's Patent). | 541 |
| SCHAW, COL. H., R.E. | Coast Defence | 1139 |
| SHELDON, M. FRENCH | Salammbô of Gustave Flaubert (<i>Notice of Book</i>). | 835 |
| STEVENS, JOHN L. | History of Gustavus Adolphus (<i>Notice of Book</i>). | 1070 |
| STEWART, COL. C. E., C.B., C.M.G. C.I.E. (Bengal Staff Corps). | On the use of Petroleum as Fuel in Steamships and Locomotives, based on its employment in that way in the Caspian Sea and the Trans-Caspian Region. | 927 |
| STONE, CAPT. F. G., R.A. | Tactical Studies from the Franco-German War of 1870-71. | 1067 |
| STURDEE, LIEUT. FREDERICK, C.D., R.N. | The Changes in the Conditions of Naval Warfare. (Naval Prize Essay.) | 367 |
| TOVEY, LIEUT.-COL., R.E. | Martial Law and the Custom of War (<i>Notice of Book</i>). | 366 |
| VAMBÉRY, ARMINIUS | The coming struggle for India (<i>Notice of Book</i>). | 365 |
| WALFORD, MAJOR, R.A. | The Parliamentary Generals of the Great Civil War (<i>Notice of Book</i>). | 366 |
| WARTENBURG, GRAF. YORCK V. .. | Napoleonals Feldherr (<i>Notice of Book</i>) | 1229 |
| WEST, MAJOR M. R., R.H.A. .. | Suggestions for the adoption and adaptation of the Single Barrel Machine-Gun for the various branches of Land Service. | 21 |
| WHEELER, J. TALBOYS | India under British rule (<i>Notice of Book</i>). | 1230 |
| WILSON, COL. SIR C. W. | From Korti to Khartoum (<i>Notice of Book</i>). | 365 |

The Journal

OF THE

Royal United Service Institution.

VOL. XXX.

1886-7.

APPENDIX.

PROCEEDINGS OF THE FIFTY-SIXTH ANNIVERSARY MEETING.

THE FIFTY-SIXTH ANNIVERSARY MEETING of the Members was held in the Theatre of the Institution on Saturday, March 5th, 1887.

THE RIGHT HON. LORD HARRIS, UNDER SECRETARY OF STATE FOR WAR, IN THE CHAIR.

I. The Secretary read the Notice convening the Meeting.

THE CHAIRMAN: This will be a convenient moment for me to explain that my Rt. Hon. Friend, the Secretary of State for War, owing to his Official and Cabinet duties, finds it impossible to attend here to-day, very much to his own regret, and I am sure to yours. He has at the last moment asked me to act as his substitute—a very inadequate one—and I therefore must beg your indulgence under these circumstances, and also your assistance in carrying through the business of the day.

THE SECRETARY: Lord Charles Beresford, M.P., who was anxious to have attended the meeting to-day, having been unfortunately called away from town has written me this letter, which I will read:—

March 4, 1887.

I am very sorry that I cannot attend the Meeting of the United Service Institution to-morrow as I intended, but I must go down to see the trial of the Lay Torpedo, and I cannot get back in time. I hear there is some probability of the present Institution being taken away from us by the landlord (The State); but I believe this is only a threat which has been held over us for more or less 20 years. However, as this threat no doubt does a certain amount of damage to the welfare of the Institution, would it not be well for the Governing Authorities to ask for some definite statement from the powers who have the right of eviction and the conditions? We should then have something definite to go upon. I most sincerely hope that the Institution will never go downhill, as I am satisfied that its objects and its lectures are of infinite use to the Services and the Country. I can testify to the use I have personally found it, as I am satisfied by result that the Machine Gun question would never have been thoroughly ventilated at any other place I know, with the same results as to supply for the Services. The mere fact of 21,078 numbers of the Journal having been disposed of last year, shews the appreciation in which it is held by the Services and the Public. Anything that I could ever do to further the interests and welfare of the Institution I would always joyfully undertake.

HOUSE OF COMMONS.

Yours very faithfully,
CHARLES BERESFORD.

4 M 2

Sir EDWARD FANSHAW: I should like to mention, with reference to what Lord Charles Beresford has written, that he is not aware that the Council has been for a very long time in communication with the Government upon this very matter, and is so at this moment.

II. The Fifty-sixth Annual Report was read as follows :—

1. The Council have the pleasure of submitting their FIFTY-SIXTH Annual Report.

MEMBERS.

2. Thirty-five Life Members and One hundred and Six Annual Subscribers, making a total of One hundred and Forty-one new Members, joined the Institution during the past year. The loss by death amounted to Ninety, and Sixty Members withdrew their names.

STATEMENT OF CHANGES AMONG THE MEMBERS SINCE 1ST JANUARY, 1886.

| | Life. | Annual. | Total. |
|---|-------|---------|--------|
| Number of Members, 31st December, 1885 | 1,428 | 2,949 | 4,377 |
| Number of Members joined during 1886 .. | 35 | 106 | 141 |
| | <hr/> | <hr/> | <hr/> |
| | 1,463 | 3,055 | 4,518 |
| Changed from Annual to Life + | 5 | — 5 | |
| | <hr/> | <hr/> | <hr/> |
| | 1,468 | 3,050 | 4,518 |
| | <hr/> | <hr/> | <hr/> |
| | Life. | Annual. | |
| Deduct—Deaths during 1886 .. | 26 | 64 | |
| Withdrawals .. | — | 60 | |
| | <hr/> | <hr/> | |
| | 26 | 124 | 26 |
| | <hr/> | <hr/> | <hr/> |
| Actual number on 31st December, 1886 .. | 1,442 | 2,926 | 4,368 |
| | <hr/> | <hr/> | <hr/> |

A tabular analysis of the present and past state of the Institution is given in the Appendix, page 7.

FINANCE.

3. An Abstract of the Accounts, duly audited, is given on the following page.

GENERAL ABSTRACT OF THE ACCOUNTS OF THE ROYAL UNITED SERVICE INSTITUTION. FROM 1ST JANUARY TO 31ST DECEMBER, 1886.

PROCEEDINGS OF THE FIFTY-SIXTH ANNIVERSARY MEETING.

iii

| EXPENDITURE. | | £ | s. | d. | £ | s. | d. | RECEIPTS. | £ | s. | d. |
|---|-----|-----|-----|-----|-------|----|----|-------------------------------------|-----|-----|-------------|
| Secretary's Salary | ... | ... | ... | ... | 400 | - | - | Annual Subscriptions, at 10s. | ... | ... | 136 10 - |
| Librarian's Salary | ... | ... | ... | ... | 180 | - | - | " " above 10s. | ... | ... | 2,585 15 6 |
| Clerk's Salary | ... | ... | ... | ... | 75 | 7 | 6 | " " arrears | ... | ... | 26 10 - |
| Servants' Wages | ... | ... | ... | ... | 536 | 4 | 6 | " " advance | ... | ... | 9 1 - |
| Ditto Clothing... | ... | ... | ... | ... | 74 | 15 | - | Entrance Fees | ... | ... | 2,757 16 6 |
| Insurance... | ... | ... | ... | ... | 22 | 15 | - | Dividends | ... | ... | 141 - |
| Ground Rent | ... | ... | ... | ... | 193 | 13 | - | Sale of Journals | ... | ... | 514 1 4 |
| Fuel | ... | ... | ... | ... | 58 | 4 | 8 | Miscellaneous Receipts | ... | ... | 456 5 6 |
| Lighting | ... | ... | ... | ... | 31 | 14 | 9 | Interest on Money on Deposit | ... | ... | 1 16 7 |
| Assessed Taxes | ... | ... | ... | ... | 92 | 6 | 10 | Government Grant | ... | ... | 12 12 5 |
| Rates | ... | ... | ... | ... | 124 | 10 | 8 | | ... | ... | 600 - |
| Artificers | ... | ... | ... | ... | 92 | 14 | - | | ... | ... | ... |
| Library (purchase of Books and Maps, &c.) | ... | ... | ... | ... | 192 | 19 | 4 | Life Subscriptions received in 1886 | ... | ... | 358 - |
| Museum | ... | ... | ... | ... | 2 | 17 | 9 | | ... | ... | ... |
| Advertisements | ... | ... | ... | ... | 194 | 18 | 6 | | ... | ... | ... |
| Printing, Stationery, &c. | ... | ... | ... | ... | 174 | 5 | 1 | | ... | ... | ... |
| Lectures | ... | ... | ... | ... | 4 | 18 | 7 | | ... | ... | ... |
| Journal | ... | ... | ... | ... | 1,481 | 18 | 1 | | ... | ... | ... |
| Postage { Letters | ... | ... | ... | ... | 27 | 17 | 5 | | ... | ... | ... |
| { Journals | ... | ... | ... | ... | 268 | 16 | 5 | | ... | ... | ... |
| House Expenses and Sundries | ... | ... | ... | ... | 296 | 13 | 10 | | ... | ... | ... |
| Gold Medal | ... | ... | ... | ... | 63 | 16 | 3 | | ... | ... | ... |
| Cash repaid to Agents | ... | ... | ... | ... | 11 | 10 | - | | ... | ... | ... |
| Charges from Agents | ... | ... | ... | ... | 19 | 13 | - | | ... | ... | ... |
| For £293 15s. 2d. New 3 per cents. at 102 | ... | ... | ... | ... | - | 3 | 5 | | ... | ... | ... |
| For £295 11s. 4d. " at 101½ | ... | ... | ... | ... | 300 | - | - | | ... | ... | ... |
| Balance { Cash in Bank | ... | ... | ... | ... | 111 | 2 | 2 | Cash in Bank, 31st December, 1885 | ... | ... | 200 5 9 |
| { Cash in hand, Postage account | ... | ... | ... | ... | - | 11 | 9 | Cash in hand, Postage account | ... | ... | 15 7 |
| | | | | | | | | | | | £5,042 13 8 |

J. DAY,
Accountant.

Audited and found correct—
2nd February, 1887.
E. R. WETHERED, Lt.-Col. }
LIONEL C. DRUMMOND, } Auditors.

ESTIMATE OF RECEIPTS AND EXPENDITURE FOR THE YEAR 1887.

| EXPENDITURE. | | | | RECEIPTS. | | | |
|--|--------|----|----|--|--------|----|----|
| | £ | s. | d. | | £ | s. | d. |
| Secretary's Salary and Lodging allowance | 400 | - | - | Balance at Bankers', 31st Dec., 1886 | 111 | - | - |
| Librarian's Salary | 190 | - | - | Annual Subscriptions : | | | |
| Clerk's do. | 76 | - | - | £ s. d. | | | |
| Servants' Wages | 537 | - | - | At 10s. .. 150 | - | - | |
| Ditto Clothing | 75 | - | - | Above 10s. 2,700 | - | - | |
| Insurance | 23 | - | - | | 2,850 | - | - |
| Ground Rent | 205 | - | - | Entrance Fees | 200 | - | - |
| Fuel | 60 | - | - | Dividends | 520 | - | - |
| Lighting | 50 | - | - | Government Grant | 600 | - | - |
| Assessed and Income Taxes | 90 | - | - | Sale of Journals | 450 | - | - |
| Parish and Water Rates | 140 | - | - | | | | |
| Artificers, Repairs, &c. .. | 150 | - | - | | | | |
| Museum | 50 | - | - | | | | |
| Gold Medal | 12 | - | - | | | | |
| Library and Topographical Departments | 250 | - | - | | | | |
| Advertisements | 160 | - | - | | | | |
| Printing Circulars & Stationery | 180 | - | - | | | | |
| Maps, Diagrams, &c., for Lectures | 50 | - | - | | | | |
| Journals, including Printing Annual Report and List of Members | 1,400 | - | - | | | | |
| Postage of Journals | 280 | - | - | | | | |
| Postage | 30 | - | - | | | | |
| House Expenses and Sundries | 80 | - | - | | | | |
| Balance | 243 | - | - | | | | |
| Total | £4,731 | - | - | Total | £4,731 | - | - |

LIFE SUBSCRIPTIONS AND CAPITAL ACCOUNT.

4 Life Subscriptions to the amount of £400, and £200 of "Income" (the latter to the Building Fund), have been invested in New Three per Cents., producing £589 6s. 6d., thus raising the funded property of the Institution to £17,492 5s. 8d. on the 1st January, 1887.

THE FUTURE LOCALITY OF THE INSTITUTION.

5. The Council is now in communication with the Government regarding the future locality of the Institution, but no decision has as yet been arrived at. In the meantime, they do not feel justified in incurring expenditure on the present building.

PAPERS.

6. Papers on the following subjects were read and discussed during the year, viz.:—

- LIEUTENANT A. GLEN, 14th Middlesex (Inns of Court) Rifle Volunteers, on "The Transmission of Drawings by Signal."
- CAPTAIN R. H. ARMIT, 22nd Middlesex Rifle Volunteers, on "Machine Guns; their use and abuse."
- MAJOR M. T. SALE, C.M.G., R.E. (Instructor in Field Fortification, S.M.E., Chatham), on "Land Mines."
- CAPTAIN H. T. ALLATT, Duke of Cornwall's Light Infantry (Instructor in Fortification, Royal Military College, Sandhurst), on "The use of Pigeons as Messengers in War, and the Military Pigeon Systems of Europe."
- THORSTEN NORDENFELT, Esq., on "Submarine Boats."
- MAJOR C. ARUNDEL BARKER, 2nd Battalion Royal Irish Fusiliers, on "Some suggestions as to the better training of our Infantry."
- REAR-ADMIRAL the Hon. EDMUND R. FREMANTLE, C.B., C.M.G., on "Naval Tactics."
- LIEUT.-GENERAL SIR GERALD GRAHAM, V.C., G.C.M.G., K.C.B., on "Infantry Fire Tactics, and Attack Formations."
- MR. H. G. HUNTINGTON, U.S.A., on "Aids to Navigation, stationary and floating lights, &c."
- COLONEL J. B. RICHARDSON, R.A. (Chief Instructor School of Gunnery, Woolwich), on "The 'Weldon' Range-finder."
- MR. ARNULPH MALLOCK, C.E., on "The 'Mallock' Range-finder."
- MAJOR E. G. ARMSTRONG, on "The Remington Lee magazine Rifle."
- MR. W. H. REYNOLDS (the Late), on the "Application of the system of Electric Fire to Small Arms."
- MR. PAULSON, on "Paulson's electrical, automatic, locomotive Torpedo."
- LIEUTENANT WILLIAM C. CRUTCHLEY, R.N.R., on "The offensive and defensive powers of Merchant Steamers."
- MAJOR CHARLES F. C. BERSFORD, R.E., on "The Field-telegraph; its uses in war, and its employment in the late expeditions in the Soudan and South Africa."
- MAJOR H. ELSDALE, R.E., on "The Defence of London and of England." Part I.—"The Security of London against a *coup de main*." Part II.—"The Successive Stages of the Defence."
- REAR-ADMIRAL W. ARTHUR, C.B. (The Late), on "The Defence of the Coasts and Harbours of England, Ireland, and Scotland in case of War."
- CAPTAIN J. C. R. COLOMB, late R.M.A., M.P., on "Imperial Federation, Naval and Military."
- MAJOR E. T. H. HUTTON, King's Royal Rifles (late Commanding Mounted Infantry in Egypt), on "Mounted Infantry."
- MAJOR A. D. ANDERSON, R.H.A., on "The Necessity for a partial enforcement of the Ballot for the Militia, and its bearing on the Regular Army, the Yeomanry, and the Volunteers."
- COLONEL F. G. RAVENHILL, R.A. (Inspector and Purchaser of Horses, R.A.), on "A Reserve of War Horses."
- COLONEL H. T. ARBUTHNOT, R.A. (Superintendent Royal Small Arms Factory, Enfield), on "The new military Rifle and its comparison with other military Rifles, English and Foreign."
- COLONEL C. E. STEWART, C.B., C.M.G., C.I.E., Bengal Staff Corps, on "The Use of Petroleum as Fuel in Steam Ships and Locomotives, based on its employment in that way on the Caspian Sea and in the Transcaspian Region."
- COLONEL SIR CHARLES H. NUGENT, K.C.B., late R.E., on "Imperial Federation."
- MAJOR H. E. C. KITCHENER, Duke of Cornwall's Light Infantry, on "Revolvers and their use."
- CAPTAIN S. PASFIELD OLIVER, F.S.A., F.R.G.S., late R.A., on "Recent French Operations on the Coast of Madagascar, 1882-1885."
- COLONEL H. SCHAW, R.E., on "Coast Defence."

The thanks of the Institution are due to the authors of the above papers for the valuable professional information thus afforded

THE JOURNAL.

7. The sale of the Journal produced £456 5s. 6*d.* as compared with £432 7s. 11*d.* in the previous year. An Index of Subjects and Authors in volumes XX.-XXX. of the Journal will be issued this year.

LIBRARY.

8. The Library now contains 21,778 volumes, of which Four hundred and eight have been added since the last Report; of these, one hundred and eighty-nine have been purchased, one hundred and twenty-two presented, and the remainder are bound periodicals, &c.

Donations of books and maps have been received from the Governments of Austria, Brazil, Denmark, France, Germany, Italy, the Netherlands, Russia, Spain, Sweden, Switzerland and the United States.

The thanks of the Council have been conveyed to the several Governments for these donations.

The Institution is indebted to the Lords Commissioners of the Admiralty, and to the Secretaries of State for War and India, for copies of various works issued by their departments.

The exchange of Journals with Foreign Governments and with many Scientific Societies, in this and other countries, has been continued.

MUSEUM.

9. An interesting addition has been made to the Museum by the loan of 26 Portrait Figures of Officers, N.-C. Officers and Men of the Native Armies of India, from the late Indian and Colonial Exhibition at South Kensington.

A list of the other additions to the Museum and to the Library will be found in the "Proceedings" of this day's meeting, and in the Appendix to Vol. XXX. of the Journal.

VICE-PATRONS.

10. The Council record with deep regret the deaths of the following distinguished Vice-Patrons, viz.: Field Marshals Sir Richard Dacres, G.C.B., R.A., and the Rt. Hon. Sir John Michel, G.C.B.

Sir Richard Dacres joined the Institution in 1857, and was elected a Vice-Patron last year, on attaining the rank of Field Marshal.

Sir John Michel became a Member in 1854, and was also elected a Vice-Patron on attaining the same rank.

The Council have had the pleasure of electing Field Marshals Sir Patrick Grant, G.C.B., G.C.S.I., Governor of Chelsea Hospital, and the Rt. Hon. Lord William Paulet, G.C.B., Vice-Patrons of the Institution.

VICE-PRESIDENTS.

11. The Council regret to record the death of Colonel Lord Waveney, A.D.C., F.R.S., who had been for many years a Member of the Institution, and as a Member of Council and Vice-President took part in the management of its affairs; His Lordship was much interested in all questions connected with the Reserve Forces, and frequently took part in the proceedings in the Theatre of the Institution.

The Council have had the pleasure of electing Lieut.-Gen. Lord Chelmsford, G.C.B., a Vice-President of the Institution.

CORRESPONDING MEMBERS OF COUNCIL.

12. On the 1st January, 1887, the number of Corresponding Members of Council was 266.

GOLD MEDAL.

13. The Council regret to report that only three Essays have been received in competition for the Gold Medal, the subject being—

“Lessons to be learned from the campaigns in which British Forces have been employed since the year 1865.”

General Sir Beauchamp Walker, K.C.B., Colonel A. Montgomerie, late 20th Hussars, and Col. F. Maurice, R.A., kindly undertook the duties of referees.

Their decision will be made known to this Meeting.

The subject for the Naval Essay for this year is—

“Naval attack of a fortified harbour, an enemy’s fleet being within it; full consideration is to be given to the subject of Sub-Marine Mining.”

The competition is open to Members of the Institution, and to all who are eligible to become Members.

14. The following Members retire by seniority of service on the Council, viz.:—

| | |
|--|--|
| Admiral of the Fleet Sir ALFRED P. RYDER, K.C.B. | Colonel Lord WILLIAM F. SEYMOUR. |
| Colonel LONSDALE HALE, late R.E. | Admiral Sir EDWARD G. FANSHAWE, K.C.B. |
| Major-General E. H. CLIVE. | Colonel MALCOLM S. GREEN, C.B. |
| Rear-Admiral LINDESAY BRINE. | Colonel Sir CHARLES H. NUGENT, K.C.B., late R.E. |

The Council submit the names of ten Members, from which vacancies may be filled up. The first eight on the list are proposed for immediate election, viz.:—

| | |
|---|---------------------------|
| Admiral Sir EDWARD FANSHAWE, K.C.B. | } For re-election. |
| Rear-Admiral LINDESAY BRINE. | |
| Colonel LONSDALE HALE. | |
| Admiral the Earl of CLANWILLIAM, C.B., K.C.M.G. | } For immediate election. |
| Colonel G. H. MONCRIEFF, late Scots Guards. | |
| Vice-Admiral Sir ANTHONY HOSKINS, K.C.B. | |
| Colonel D. M. HOME, Royal Horse Guards. | |
| Major-General Sir WILLIAM CROSSMAN, K.C.M.G., M.P., late R.E. | |
| Captain A. ABERCROMBIE JOPP, late R.E., Director-General, Store Department, India Office. | |
| Captain P. H. COLOMB, R.N. | |

CONCLUSION.

In conclusion, the Council consider that, although there has been a decrease in the number of the Members, the finances of the Institution are in a sound and satisfactory condition.

WHITEHALL YARD,

17th February, 1887.

By Order,

B. BURGESS, CAPTAIN,

Secretary.

APPENDIX.—TABULAR ANALYSIS OF THE STATE OF THE INSTITUTION

| Year. 1st Jan. to 31st Dec. | Annual Subs. received. | En- trance Fees. | Income (from all sources). | Life Subs. received. | Amount of Stock. | Invested in the pur- chase of Books, &c. | No. of Vols. in Library. | No. of Members on the 31st Dec. | Number of Visitors. |
|--------------------------------------|------------------------------|------------------------|----------------------------------|----------------------------|---------------------|---|--------------------------------|--|---------------------------|
| £ | £ | £ | £ | £ | £ | £ | | | |
| 1831 | 654 | .. | 654 | 1,194 | .. | .. | .. | 1,437 | .. |
| 1832 | 1,146 | .. | 1,146 | 973 | .. | .. | .. | 2,699 | .. |
| 1833 | 1,405 | .. | 1,450 | 692 | .. | .. | .. | 3,341 | .. |
| 1834 | 1,500 | .. | 1,549 | 583 | 1,100 | .. | .. | 3,748 | 13,376 |
| 1835 | 1,480 | .. | 1,574 | 366 | 2,430 | 40 | .. | 4,155 | 8,537 |
| 1836 | 1,570 | .. | 1,682 | 330 | 3,747 | 45 | .. | 4,069 | 8,521 |
| 1837 | 1,549 | .. | 1,747 | 222 | 4,747 | 180 | .. | 4,164 | 10,907 |
| 1838 | 1,462 | .. | 1,634 | 230 | 5,500 | 246 | .. | 4,175 | 15,788 |
| 1839 | 1,399 | .. | 1,565 | 168 | 5,500 | 292 | .. | 4,186 | 16,248 |
| 1840 | 1,363 | .. | 1,525 | 198 | 5,500 | 446 | 5,500 | 4,257 | 17,120 |
| 1841 | 1,450 | .. | 1,643 | 186 | 6,000 | 243 | 5,850 | 4,243 | 19,421 |
| 1842 | 1,373 | .. | 1,565 | 144 | 6,400 | 373 | 6,450 | 4,127 | 21,552 |
| 1843 | 1,299 | .. | 1,494 | 140 | 6,700 | 237 | 7,000 | 4,078 | 27,056 |
| 1844 | 1,274 | .. | 1,408 | 112 | 3,000 | 298 | 7,850 | 3,968 | 22,767 |
| 1845 | 1,313 | .. | 1,466 | 228 | 1,500 | 127 | 8,100 | 3,988 | 21,627 |
| 1846 | 1,298 | .. | 1,456 | 138 | 1,500 | 74 | 8,410 | 4,031 | 32,835 |
| 1847 | 1,314 | 74 | 1,502 | 132 | 1,700 | 37 | .. | 4,017 | 38,699 |
| 1848 | 1,175 | 57 | 1,375 | 48 | 1,700 | 85 | 9,641 | 3,947 | 37,140 |
| 1849 | 1,176 | 72 | 1,375 | 84 | 1,150 | 58 | .. | 3,970 | 33,333 |
| 1850 | 1,141 | 106 | 1,294 | 198 | 600 | 36 | .. | 3,998 | 33,773 |
| 1851 | 1,136 | 131 | 1,292 | 66 | 666 | 34 | 10,150 | 3,188 | 52,173 |
| 1852 | 1,134 | 133 | 1,281 | 114 | 200 | 43 | 10,300 | 3,078 | 20,609 |
| 1853 | 1,243 | 319 | 1,684 | 264 | 528 | 41 | 10,420 | 3,251 | 25,952 |
| 1854 | 1,200 | 138 | 1,368 | 126 | 612 | 95 | 10,587 | 3,171 | 22,661 |
| 1855 | 1,159 | 107 | 1,289 | 120 | 653 | 55 | 10,780 | 3,131 | 14,778 |
| 1856 | 1,216 | 197 | 1,519 | 156 | 761 | 47 | 10,832 | 3,204 | 16,184 |
| 1857 | 1,258 | 176 | 1,937 | 78 | 1,038 | 40 | 10,960 | 3,168 | 12,755 |
| 1858 | 1,318 | 221 | 2,102 | 105 | 438 | 31 | 11,062 | 3,246 | 25,747 |
| 1859 | 1,526 | 195 | 2,277 | 512 | 946 | 70 | 11,320 | 3,344 | 28,739 |
| 1860 | 1,961 | 298 | 3,577 | 397 | 2,178 | 114 | 11,517 | 3,518 | 23,011 |
| 1861 | 2,122 | 305 | 2,899 | 266 | 2,846 | 99 | 11,812 | 3,689 | 23,296 |
| 1862 | 2,296 | 242 | 3,127 | 239 | 3,178 | 109 | 12,026 | 3,797 | 27,215 |
| 1863 | 2,379 | 218 | 3,100 | 405 | 3,583 | 143 | 12,296 | 3,847 | 18,150 |
| 1864 | 2,425 | 215 | 3,253 | 222 | 4,516 | 116 | 12,700 | 3,902 | 17,276 |
| 1865 | 2,435 | 154 | 3,467 | 235 | 4,804 | 137 | 13,000 | 3,895 | 18,253 |
| 1866 | 2,435 | 157 | 3,488 | 299 | 5,486 | 150 | 13,337 | 3,891 | 17,067 |
| 1867 | 2,431 | 141 | 3,467 | 208 | 5,732 | 140 | 13,890 | 3,823 | 17,211 |
| 1868 | 2,446 | 184 | 3,534 | 297 | 6,396 | 119 | 14,100 | 3,812 | 16,417 |
| 1869 | 2,368 | 165 | 3,485 | 238 | 6,653 | 232 | 14,669 | 3,792 | 15,947 |
| 1870 | 2,376 | 178 | 3,493 | 333 | 7,313 | 140 | 15,055 | 3,831 | 18,654 |
| 1871 | 2,455 | 237 | 3,677 | 538 | 7,748 | 202 | 15,501 | 3,922 | 19,420 |
| 1872 | 2,620 | 336 | 4,111 | 713 | 8,927 | 192 | 15,761 | 4,116 | 19,773 |
| 1873 | 2,776 | 295 | 4,316 | 535 | 9,465 | 222 | 16,227 | 4,276 | 18,183 |
| 1874 | 2,819 | 216 | 4,491 | 409 | 10,189 | 218 | 16,624 | 4,330 | 16,771 |
| 1875 | 2,801 | 154 | 4,595* | 469 | 10,721 | 228 | 17,000 | 4,308 | 15,960 |
| 1876 | 2,794 | 162 | 4,500 | 437 | 11,305 | 171 | 17,700 | 4,320 | 15,543 |
| 1877 | 2,840 | 218 | 4,750 | 526 | 11,725 | 217 | 18,300 | 4,405 | 15,682 |
| 1878 | 2,881 | 231 | 4,700 | 459 | 12,091 | 231 | 18,750 | 4,485 | 17,881 |
| 1879 | 2,904 | 180 | 4,490 | 407 | 12,505 | 254 | 19,170 | 4,473 | 15,529 |
| 1880 | 2,962 | 255 | 5,115* | 577 | 12,965 | 240 | 19,565 | 4,531 | 13,041 |
| 1881 | 2,893 | 238 | 4,967 | 645 | 13,670 | 240 | 19,920 | 4,577 | 12,507 |
| 1882 | 2,829 | 181 | 4,739 | 491 | 14,069 | 174 | 20,352 | 4,591 | 12,546 |
| 1883 | 2,892 | 205 | 5,023 | 692 | 15,251 | 157 | 20,658 | 4,627 | 11,482 |
| 1884 | 2,851 | 172 | 4,950 | 491 | 16,000 | 207 | 20,943 | 4,613 | 12,388 |
| 1885 | 2,857 | 181 | 5,121 | 545 | 16,902 | 169 | 21,370 | 4,377 | 12,220 |
| 1886 | 2,757 | 141 | 4,842 | 358 | 17,492 | 192 | 21,773 | 4,368 | 12,353 |

* A legacy of £100 was received this year.

Colonel The Rt. Hon. J. H. MACDONALD, C.B., M.P. :—

Lord Harris and Gentlemen,—I have been asked to move this Resolution—“That the Report now read be adopted and printed for circulation among the Members.” I move accordingly.

The Resolution having been seconded by Major-General Sir William Crossman, M.P., was then put from the Chair and was carried unanimously.

III.—Lt.-General LOTHIAN NICHOLSON, C.B., R.E. :—

My Lords and Gentlemen,—I have been asked to propose the second Resolution, to the following effect :—“That the thanks of this Meeting be given to the Members of the Council who retire by rotation, and that the following Members be elected to fill the vacancies, viz. :—

| | |
|---|---------------------------|
| Admiral Sir EDWARD FANSHAWE, K.C.B. | } For Re-Election. |
| Rear-Admiral LINDESAY BRINE. | |
| Colonel LONSDALE HALE. | |
| Admiral the EARL OF CLANWILLIAM, K.C.M.G., C.B. | } For Immediate Election. |
| Col. G. A. MONCRIEFF (late Scots Guards). | |
| Vice-Admiral Sir ANTHONY HOSKINS, K.C.B. | |
| Colonel D. M. HOME (Royal Horse Guards). | |
| Maj.-Gen. Sir WM. CROSSMAN, K.C.M.G., M.P., late R.E. | |

Also that the following names of Members be adopted from which to select in case of vacancies occurring in the Council, viz. :—

Captain A. ABERCROMBIE JOPP (late R.E.), Director-General Store Department, India Office.

Captain P. H. COLOMB, R.N.

The Resolution having been seconded by the Rev. Mr. HALPIN, late Chaplain to the Forces, was put from the Chair and was carried unanimously.

IV.—Admiral Sir ERASMUS OMMANNEY :—

The motion I have to submit for your acceptance is one which I am sure will commend itself to your grateful recognition. It is the re-election of the Auditors who have taken so much pains and care in auditing our accounts, the state of which, as we have heard in the Report, is in the main so satisfactory. The high standing and professional ability of these gentlemen needs no comment from me. I am sure we are exceedingly favoured in having gentlemen of that class who take so much care and diligence with our accounts. I therefore beg leave to propose—“That the thanks of this Meeting be given to the Auditors, Lionel Charles Drummond, Esq., and Lieut.-Colonel Wethered, for their valuable services; that the latter gentleman, who goes out by rotation, be re-elected; and that the following be the Auditors for the ensuing year :—E. R. Raitt, Esq., Lionel C. Drummond, Esq., and Lieut.-Colonel Wethered.”

The Resolution having been seconded by Capt. Jopp, late R. E., was put from the Chair and was carried unanimously.

V.—The Report of the Referees having been read by the Secretary, it was found that the winner of the Gold Medal was Captain C. E. CALLWELL, R.A.

VI.—Admiral Sir E. FANSHAWE, K.C.B. :—

The next Resolution is—“That the thanks of this Meeting be given to the Referees, General Sir Beauchamp Walker, K.C.B., Colonel A. Montgomerie, late 20th Hussars, and Colonel F. Maurice, R.A., for their valuable services in adjudicating on the Military Prize Essays.” The words “valuable services” are never better applied than on such occasions as the adjudication of these Medals. The Council, and I am sure every one else, must be fully convinced of the extreme importance of bestowing due care upon the adjudication of the Gold Medal of this Institution.

In this particular case there happen to have been only three Essays, therefore the amount of reading was not so much as it is when there are many; but still the care required is the same. There is also another consideration which was referred to in the Report of the Referees, which is the consideration whether the Essay that is selected by them as the best is of a sufficient standard to deserve the Gold Medal of the Institution. I am delighted to see that on this occasion the Referees have found it so; but I call your attention to that as showing that the Referees have fulfilled an office requiring the greatest care as well as judgment in deciding upon the various Essays forwarded for competition. I beg to move this Resolution, that a vote of thanks be given to the Referees for their valuable services.

The Resolution having been seconded by Major-General COOKE, C.B., was carried unanimously.

General Sir BEAUCHAMP WALKER, K.C.B.:—

I cannot acknowledge this vote of thanks without expressing the regret of my colleagues and myself that this very excellent subject only produced three Essays. I must say we were very much surprised at finding that there were so few to be adjudicated upon; and though that fact lightened our labours very considerably, it was to us a subject of great regret, and I am sure will be so also to you.

The Chairman having announced that the business of the Meeting was concluded, vacated the Chair, which was taken by Sir Edward Fanshawe, the Chairman of the Council.

Lt.-General LORD CHELMSFORD, G.C.B.:—

I beg to propose the following Resolution—"That the thanks of this Meeting be given to Lord Harris for having taken the Chair this day." I am sure we all feel extremely grateful to him that at the last moment he should have taken the place of the Rt. Hon. the Secretary of State for War, whom we should have been glad to have seen here; but, failing him, we could not have had a better substitute than the Under Secretary of State. The Council, and all the Members of this Institution, attach very great importance to the support of the Admiralty and War Office for this Institution, and it is a proud thing to say that we have invariably obtained the confidence of those Departments, and that at every Annual Meeting, I believe for many years past, we have had one or other Secretary of State to preside over us. At this moment we are in a critical position, and we look more than ever to the support of the Admiralty and War Office to help us in our appeal to the Treasury for assistance when we have to move from this house; I believe I am not saying more than is absolutely the truth, when I say that both the Admiralty and War Office will do all they can to assist us in this matter.

General ERSKINE:—

Mr. Chairman and Gentlemen,—I have great pleasure in seconding the Resolution which has been moved so ably by Lord Chelmsford. After what he has said, I need not trouble you with any remarks.

The Resolution was then put and carried with acclamation.

Lord HARRIS:—

Sir Edward Fanshawe, my Lords, and Gentlemen,—I imagine that no one more than myself regrets the absence of my Right Honourable friend Mr. Stanhope upon this occasion, if for no other reason, that his greater experience of this Institution, and the opportunities he has had of taking a greater interest in it during the longer course of his official life, would have rendered his presence here naturally more grateful than my own; and also on his own account I regret it, as I am sure you do, because I know it was with feelings of great disappointment he found that at the last moment the press of business was so great, that it was impossible for him to accept the invitation you had extended to him. I have understood, not only

from what has been alluded to by Lord Chelmsford, that the position of this Institution is a subject of some anxiety at this moment to its Members, and that you are looking to the Government for some signs of interest, and of material interest, in order that an Institution of such eminent value as this undoubtedly is, should maintain that position which it has held for so many years past in the eyes of the Public. I must confess from my own point of view I think that these expectations have some right to meet with material realization. Not that I have any reason to say that I have heard any mention of their being gratified; I am only expressing my own personal opinion, that an Institution of this kind does deserve some meed of State assistance. I may further say that, if it should lay in my weak power at any time to assist the Institution by strengthening its position in the opinion of the Government, I should be only too proud if that opportunity were given me. The mere perusal of the list of subjects dealt with during the year, is sufficient to show any one, that the services that this Institution gives to the country are invaluable. When we remember the extraordinary changes that have taken place in this last generation in military *matériel*, it is obvious that a full and free discussion upon all the points that are exercising the minds of both military and naval experts at this time, is absolutely necessary before the Government is approached with the object of obtaining the means to carry out those views. My experience of official life is very short, and therefore I feel that I am presumptuous in saying what I do, and I say it with the greatest diffidence; but I am convinced of this, that it is absolutely necessary that, whenever military or naval experts are convinced that a change as to *matériel* or tactics is desirable, they should go to the Government with their minds made up as to what the course of action is to be—there must be no doubt or hesitation in the minds of the military and naval experts who are to advise the political representatives of the two Services. That is the most important point, I think, about this Institution—that it affords the means of threshing out every subject of analytical discussion, and I believe in the end, in all probability, those who have to advise the Secretary of State and the First Lord of the Admiralty are able to do so with decision, and to extend that decision to the minds of their political representatives. I observe also that the Library, which had grown to considerable dimensions, has been considerably extended during this last year, that donations of books come from all parts of the world, and that an exchange of Journals goes on with various Governments and Scientific Societies. That must be assuredly a great advantage not only to this Institution, not only to the Members of the two Services, but also to the State, that that exchange of information should take place, that we should be able to take advantage of the advance of science in foreign countries, and that our Services may be benefited thereby. On that account also, it seems to me you have fair ground for going to the Government with an application for some State aid. As I said just now, when one remembers the extraordinary advance that has taken place in military *matériel* during the last 25 years, that practically the science of Artillery—I am speaking with the greatest diffidence—has practically been born again since the Crimean War; that the vast subject of Torpedo Defence has to be taken up and threshed out; that the great economic question of a horse supply; the vast question of dealing fairly with our Volunteers—all subjects which, if not raised directly, are raised indirectly in the papers that are discussed here—bearing all that in mind, it does seem to me that this Institution is one which deserves some consideration from the State; and for these reasons, if it lies at any time in my power to render it any assistance, I can assure the Members that they may depend upon my doing so. I have to congratulate this Institution on other grounds. I believe that although there has been a slight falling off in the number of Members, that that is very slight indeed, only amounting to nine; and although the amount of Subscriptions that has been received during these eight or nine years does show from 1880 a slight falling off, still the decrease is very small, and not anything like the proportion in which the incomes of other Societies and of individuals have fallen off during these last seven or eight disastrous years. On this ground I think the Institution is to be congratulated. I need not detain you, my Lords and Gentlemen, any longer, further than to thank you for the honour you have done me by allowing me to take the Chair to-day.

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376.
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Clanchy, R.N., and

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Ordinance U.S. Army.

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H.R.H. the Field Marshal Commanding in Chief.
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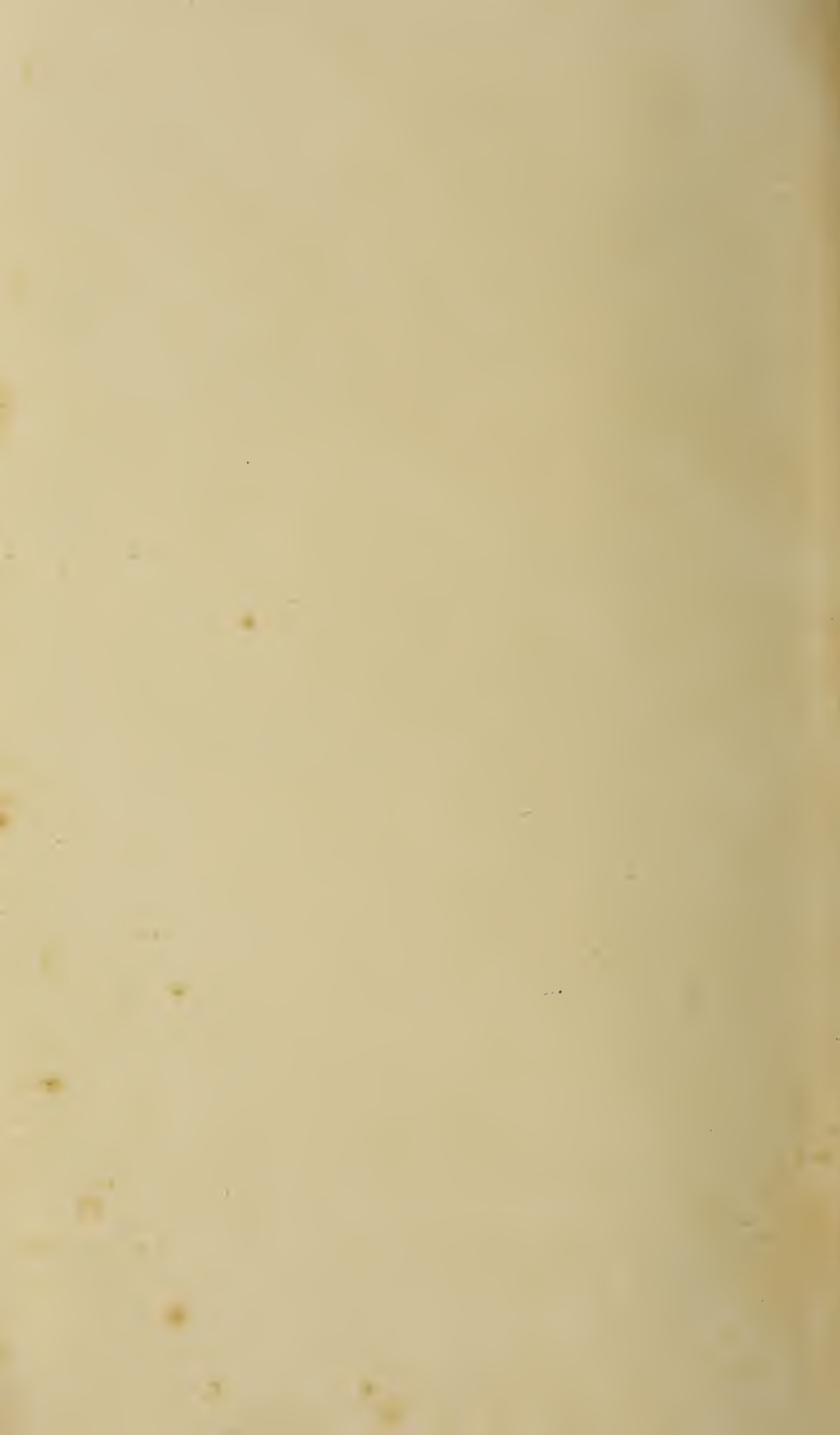
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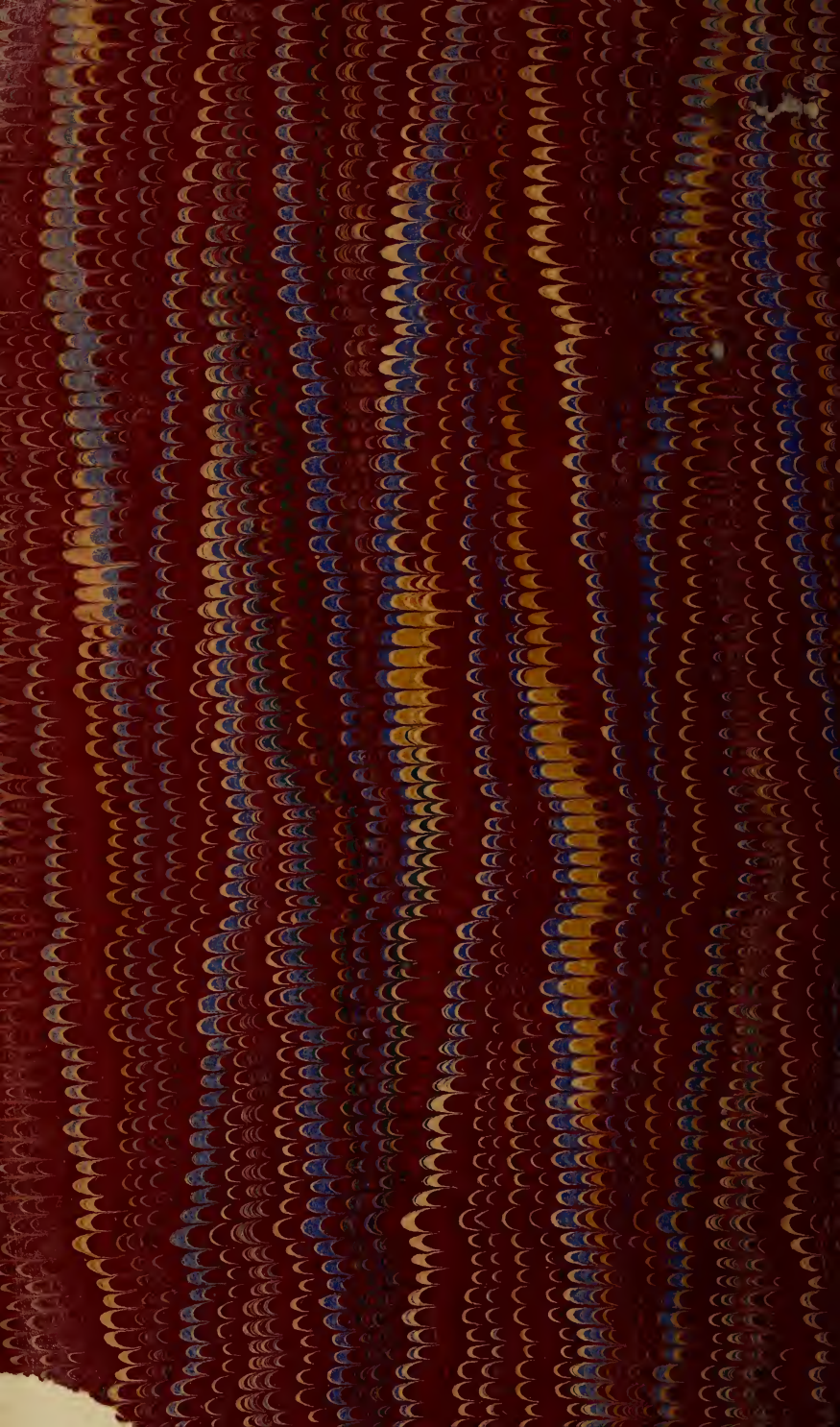
Piece of Roast Camel Hide, being a
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Arabs at Tamaai.

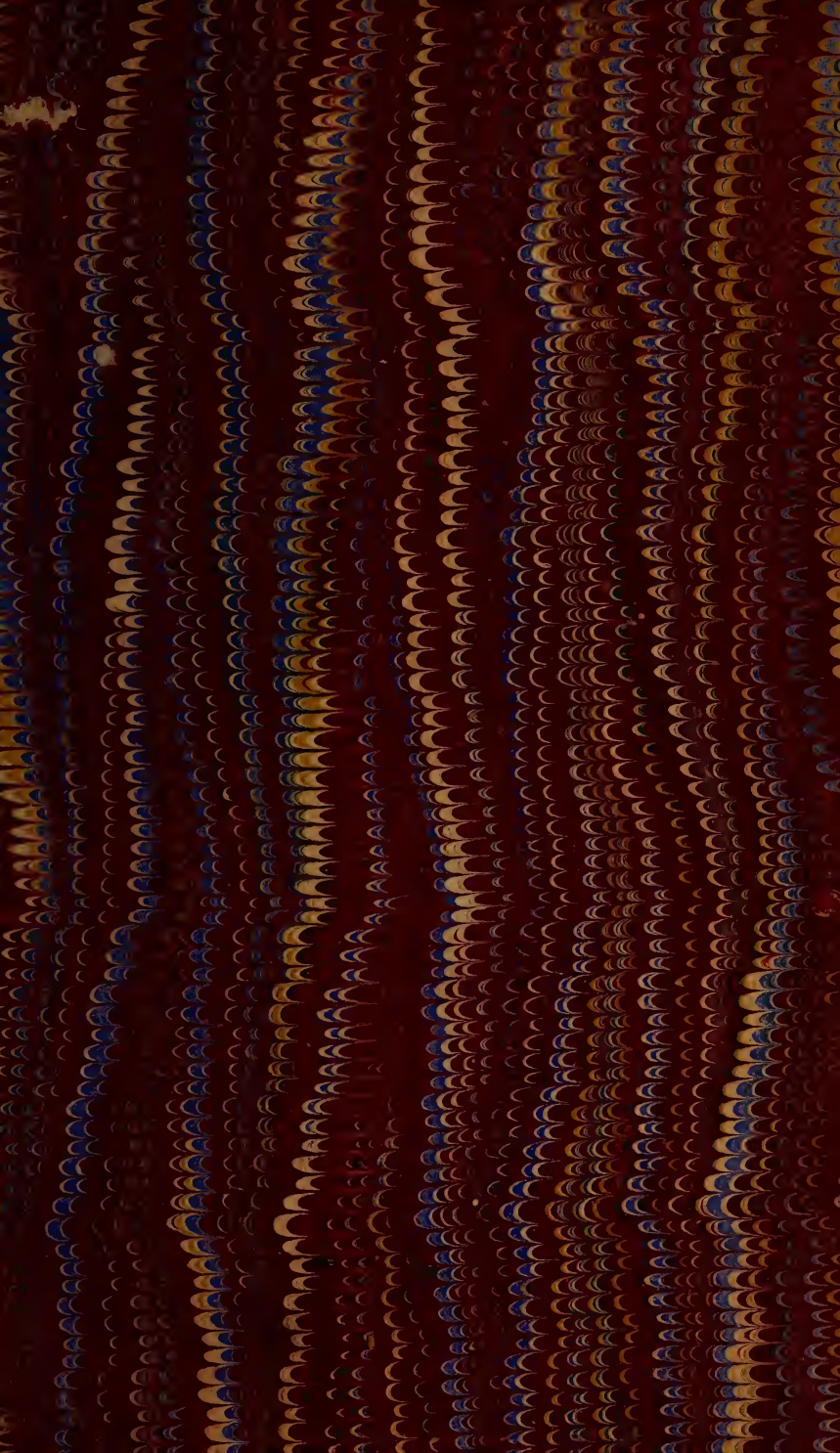
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